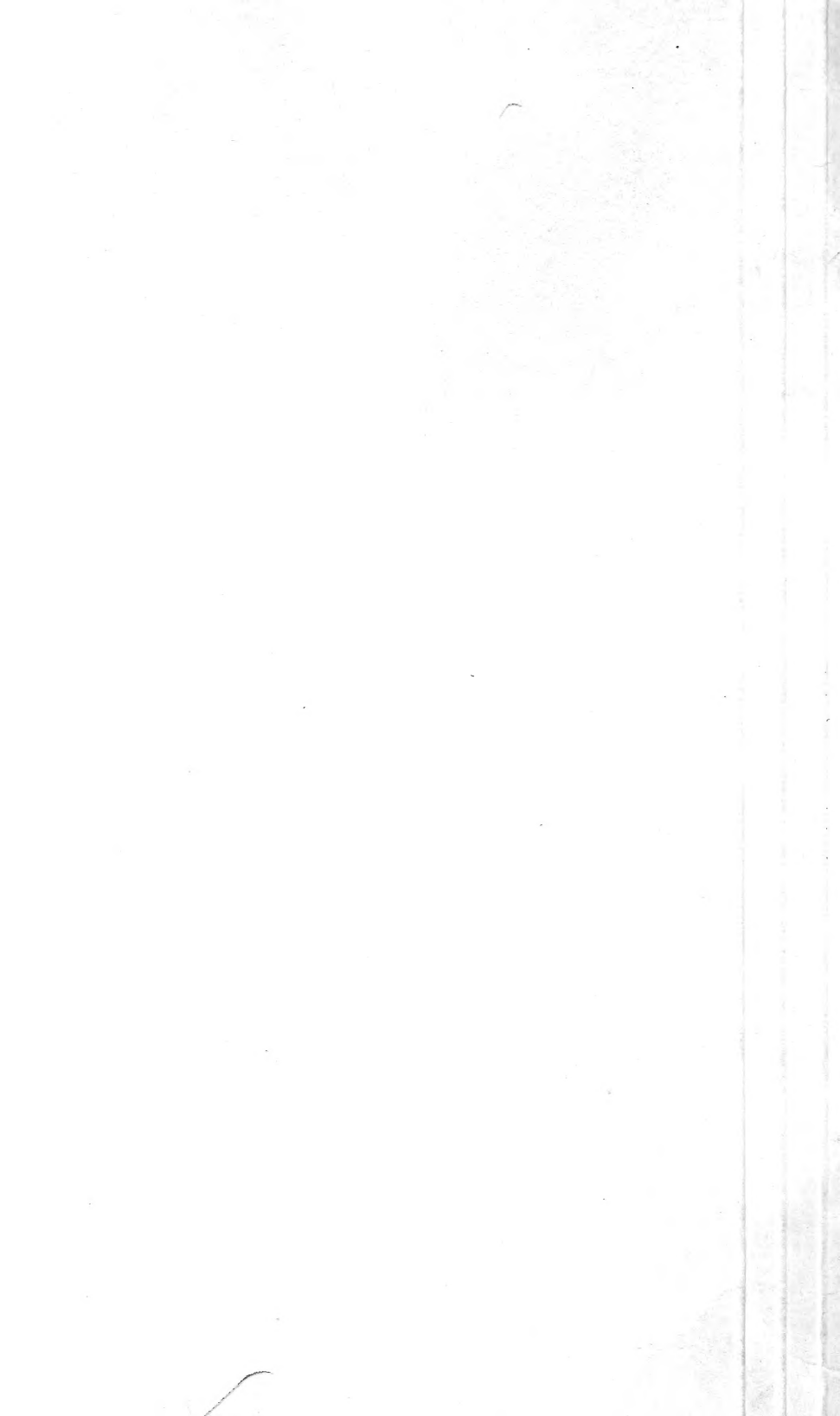


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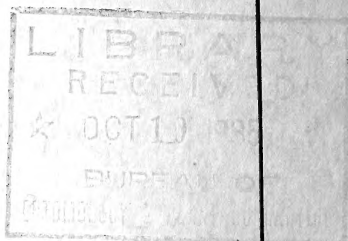
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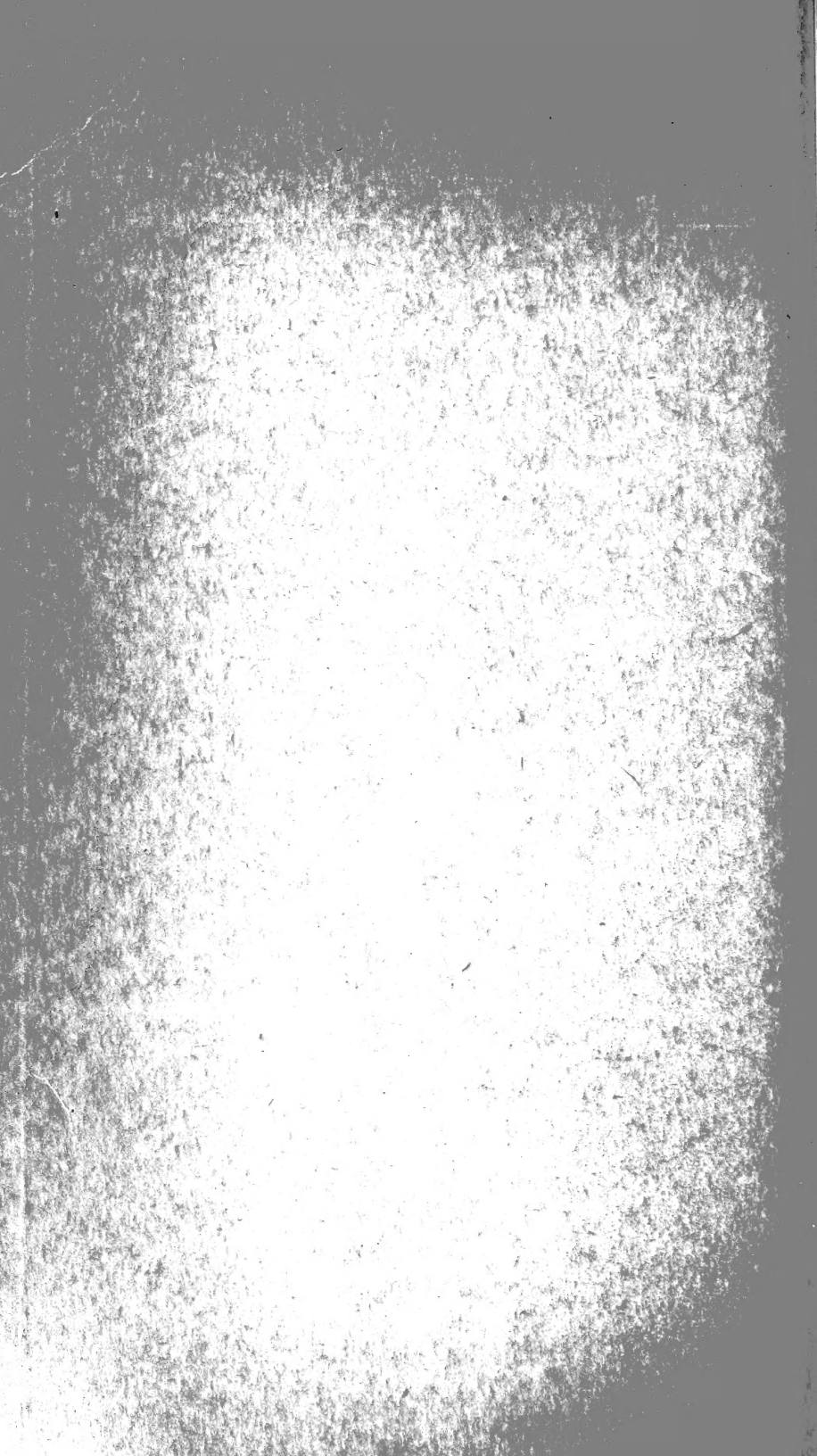
Washington, D. C.

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CONVERTING FACTORS  
AND TABLES OF EQUIVALENTS  
USED IN FORESTRY

Prepared in the Division of Silvical  
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### CONTENTS

	Page	Tables—Continued.	Page
Introduction.....	1	Ratios for customary map scales.....	13
Tables.....	2	Scale of velocity equivalents of the	
Length.....	2	Beaufort scale of wind.....	13
Area or surface.....	3	Relative humidity.....	14
Volume and capacity.....	3	Quarter girth units.....	15
Weight.....	4	Natural trigonometric functions.....	15
Velocity.....	4	International log rule.....	16
Power.....	5	Scribner decimal C log rule.....	17
Weight as applied to length.....	5	Solid cubic contents of logs.....	18
Weight or pressure as applied to area.....	5	Comparison of log rules.....	19
Weight as applied to volume.....	6	Charts.....	21
Volume of various units of weight of		Temperature, figure 1.....	21
water.....	6	Length, figures 2-3.....	23, 25
Weight of various units of volume of		Area, figures 4-7.....	27-33
water.....	7	Volume, figures 8-10.....	35-39
Rainfall per unit area.....	7	Weight, figure 11.....	41
Reservoir capacity.....	7	Power, figure 12.....	43
Discharge or flow of water.....	8	Wood volume, figure 13.....	45
Approximate quantities of forest prod-		Wood volume and basal area per unit of	
ucts represented by board foot measure.....	8	area, figures 14-15.....	47, 49
Approximate equivalents of forest prod-		Weight and volume per unit of area,	
ucts.....	8	figure 16.....	51
Area of squares.....	9	Volume per unit of area and weight per	
Area of small circles (basal area).....	10	unit of volume, figure 17.....	53
Area of large circles.....	12	Discharge or flow of water, figure 18.....	55
Number of trees per acre.....	12	Value per unit of area, figure 19.....	57
Grades and slopes.....	12	Coefficients of correlation, figure 20.....	59

### INTRODUCTION

The increasing use of metric measurements in the natural sciences is causing considerable confusion and difficulty in interpreting data. This is particularly marked in forestry where not only are direct measurements involved, but these measurements are also applied to different units of area. Thus while the conversion of centimeters to inches is a relatively simple matter, the conversion of board feet per acre to cubic meters per hectare is fraught with difficulties which are further increased when monetary values are involved. The purpose of this handbook is to provide members of the Forest Service with conversion factors and forest measurements that are more or less frequently encountered in forestry literature. These are expressed in tabular form where it appears most advantageous to do so; in the

<sup>1</sup> By E. N. Munns, assisted by Theresa G. Hoerner and V. A. Clements.

other cases a series of alinement charts have been prepared which permit the direct determination of values in multiple form. There are included also certain other tables giving data more or less commonly used in forest calculations.

In the tables the unit value on which the conversion is based is indicated as **1**. Conversion units are not carried beyond six decimal places. When the final digit is not exact but represents a rounding to the nearest value, it is italicized. Figures in parentheses ( ) below the decimal figure are approximate values for use in rough calculations where a high degree of accuracy is unnecessary. Figures in brackets [ ] below the decimal figure are exact values.

The tables are adapted for ready use. An example or two will best illustrate this. Given the average height of a stand as 42.67 meters, to convert to feet: In table 1, column 9 is headed "Meters"; on the same line with the figure **1** in this column will be found all the various conversion factors that are likely to be needed by the forester; the factor under "Feet" is 3.280833, by which the given height, 42.67 meters, is converted to 139.993 feet. Similarly, a cubic centimeter of a certain tree seed weighs 0.35 gram; how much will a bushel, avoirdupois, of this seed weigh? In table 9 the factor for pounds per bushel, found by locating first the figure **1** under "Grams per cubic centimeter" is 77.6893. This factor gives 27.19 pounds per bushel.

In all the tables, United States units of weight are understood to be avoirdupois unless otherwise specified.

## TABLES

TABLE 1.—Length; unit conversion factors, with approximate values

Inches	Links	Feet	Yards	Rods	Chains <sup>1</sup>	Miles <sup>2</sup>	Centi-meters	Meters	Kilo-meters
<sup>3</sup> <b>1</b>	0.126263 ( $\frac{1}{8}$ )	0.083333 [ $\frac{1}{12}$ ]	0.027778 [ $\frac{1}{36}$ ]	0.00505 ( $\frac{1}{200}$ )	-----	-----	2.540605 (2 $\frac{1}{2}$ )	0.0254 ( $\frac{1}{40}$ )	-----
<b>7.92</b>	<b>1</b>	0.66 ( $\frac{2}{3}$ )	0.22 [ $\frac{1}{5}$ ]	0.04 [ $\frac{1}{25}$ ]	0.01 [ $\frac{1}{100}$ ]	-----	20.11684 (20)	0.201168 ( $\frac{1}{5}$ )	-----
12	1.515152 (1 $\frac{1}{2}$ )	<sup>3</sup> <b>1</b>	0.333333 [ $\frac{1}{3}$ ]	0.060606 ( $\frac{1}{16}$ )	0.015152 [ $\frac{1}{66}$ ]	0.000189	30.48006 (30)	0.304801 ( $\frac{3}{10}$ )	0.000305
36	4.545455 (4 $\frac{1}{2}$ )	3	<sup>3</sup> <b>1</b>	0.181818 ( $\frac{1}{5}$ )	0.045455 ( $\frac{1}{22}$ )	0.000568	91.44018	0.914402 ( $\frac{9}{10}$ )	0.000914
<b>0.3937</b> ( $\frac{2}{5}$ )	0.04971 ( $\frac{1}{20}$ )	0.032808 ( $\frac{1}{30}$ )	0.010936 ( $\frac{1}{90}$ )	-----	-----	-----	<sup>4</sup> <b>1</b>	0.01	-----
39.37 (40)	4.97096 (5)	3.280833	1.09361	0.198838 ( $\frac{1}{5}$ )	0.04971 ( $\frac{1}{20}$ )	0.000621 ( $\frac{1}{1600}$ )	100	<b>1</b>	0.601
							Furlongs		
198	25	16.5	5.5	<b>1</b>	0.25 [ $\frac{1}{4}$ ]	0.003125 [ $\frac{1}{320}$ ]	0.025 [ $\frac{1}{40}$ ]	5.02921 (5)	0.005029 ( $\frac{1}{200}$ )
792	100	66	22	4	<b>1</b>	0.0125 [ $\frac{1}{80}$ ]	0.1 ( $\frac{1}{10}$ )	20.1168 (20)	0.020117 ( $\frac{1}{50}$ )
-----	-----	5,280	1,760	320	80	<b>1</b>	8	1,609.347 (1,600)	1.609347 ( $\frac{1}{6}$ )
-----	-----	660	220	40	10	0.125 [ $\frac{1}{8}$ ]	<b>1</b>	201.168 (201)	0.201168 ( $\frac{1}{5}$ )
-----	-----	3,280.83	1,093.61	198.838 (200)	49.7096 (50)	0.62137 ( $\frac{5}{8}$ )	4.97096 (5)	1,000	<b>1</b>

<sup>1</sup> Surveyor's chain; the engineer's chain=100 links of 1 foot each is not used.

<sup>2</sup> 1 nautical mile (termed "knot" as unit of velocity)=1.1516 statute miles=1.85325 km=1 inch of arc on the earth's surface at the Equator.

<sup>3</sup> British units: 1 yard=0.914399 m; 1 foot=30.47997 cm; 1 inch=2.539998 cm; 1 hand=4 inches=10.16 cm; 1 span=9 inches=22.86 cm; 1 cubit=18 inches=45.72 cm.

<sup>4</sup> 1 millimeter=0.1 cm=0.03937 inch=0.00328 foot.

TABLE 2.—Area or surface; unit conversion factors, with approximate values

Square inches	Square links	Square feet	Square yards	Square chains	Acres	Square centimeters	Square meters	Hectares	Square kilometers
1	0.015942 ( $\frac{1}{63}$ )	0.006944 ( $\frac{1}{144}$ )	-----	-----	-----	6.451626 (6 $\frac{1}{2}$ )	0.000645	-----	-----
62,7264 (63)	1	0.4356 ( $\frac{3}{4}$ )	-----	0.0001	0.00001	404.6873 ( $\frac{1}{2}$ )	0.040469 ( $\frac{1}{25}$ )	-----	-----
144	2.295684	1	0.111111 [ $\frac{1}{9}$ ]	0.00023	0.000023	929.034 ( $\frac{1}{11}$ )	0.092903 ( $\frac{1}{11}$ )	-----	-----
1,296	20.6612 (20)	9	1	0.002066 ( $\frac{1}{500}$ )	0.000207	8,361.31 11	0.836131 ( $\frac{1}{5}$ )	-----	-----
0.155 ( $\frac{1}{4}$ )	-----	0.001076 ( $\frac{1}{1000}$ )	-----	-----	-----	-----	0.0001	-----	-----
1,550	24.7104	10.76387 (11)	1.19599 (1 $\frac{1}{5}$ )	0.002471 ( $\frac{1}{400}$ )	0.006247	10,000	1	0.0001	-----
						Square miles			
	10,000	4,356	484	21	0.1	0.000156 [ $\frac{1}{6400}$ ]	404.687	0.040469 ( $\frac{1}{25}$ )	0.006405 ( $\frac{1}{2500}$ )
		43,560	4,840	10	31	0.0015625 [ $\frac{1}{640}$ ]	4,046.87 (4,000)	0.404687 ( $\frac{1}{25}$ )	0.004047 ( $\frac{1}{250}$ )
		27,878,400	3,097,600	6,400	640	1	2,589,998 (260)	258.9998 (260)	2.590 (2 $\frac{1}{2}$ )
		107,638.7	11,959.8 (12,000)	24.7104 (25)	2.471044 (2 $\frac{1}{2}$ )	0.003861 ( $\frac{1}{250}$ )	10,000	1	0.01
		10,763,867	1,195,985	2,471.04 (250)	247.104 (250)	0.386101 ( $\frac{1}{2}$ )	1,000,000	100	1

<sup>1</sup> 1 mm<sup>2</sup>=0.01 cm<sup>2</sup>=0.00155 square inch.

<sup>2</sup> 1 square chain=16 square rods.

<sup>3</sup> 1 acre=area 208.710 (210) feet square=3.16 chains square.

TABLE 3.—Volume and capacity; unit conversion factors, with approximate values

United States measure of volume <sup>1</sup>		United States dry measure, quarts	United States apothecaries' and liquid measure <sup>2</sup>				Metric system		
Cubic inches	Cubic feet		Fluid ounces	Pints	Quarts	Gallons	Cubic centimeters <sup>3</sup>	Liters <sup>4</sup>	Cubic meters (steres)
1	0.000579	0.014881	0.554113 ( $\frac{1}{2}$ )	0.034632 ( $\frac{1}{30}$ )	0.017316 ( $\frac{1}{60}$ )	0.004329	16.3872 (16)	0.016387 ( $\frac{1}{60}$ )	-----
1,728	1	25.714 (26)	957.5	59.8442 (60)	23.9221 (30)	7.48052 (7 $\frac{1}{2}$ )	28,317	28.316 (28)	0.028317 ( $\frac{1}{35}$ )
1.80469 (1 $\frac{1}{2}$ )	-----	-----	1	0.0625 [ $\frac{1}{16}$ ]	0.03125 [ $\frac{1}{32}$ ]	-----	29.5737 (30)	0.029573 ( $\frac{1}{34}$ )	-----
23.875 (30)	-----	0.429684 ( $\frac{3}{4}$ )	16	1	0.5 [ $\frac{1}{2}$ ]	0.125 [ $\frac{1}{8}$ ]	473.179 (475)	0.473167 ( $\frac{1}{2}$ )	-----
57.75 (58)	0.033429 ( $\frac{1}{30}$ )	0.859367 ( $\frac{3}{4}$ )	32	2	1	0.25 [ $\frac{1}{4}$ ]	946.359 (950)	0.946333 (1)	0.000946
231	0.133681 ( $\frac{1}{8}$ )	3.43747	128	8	4	1	3785.43 (4,000)	3.785332 (4)	0.003785 ( $\frac{1}{265}$ )
0.061023 ( $\frac{1}{16}$ )	-----	0.000908	0.033814 ( $\frac{1}{30}$ )	0.062113 ( $\frac{1}{1000}$ )	0.061057 ( $\frac{1}{1000}$ )	-----	1	0.0010 ( $\frac{1}{1000}$ )	0.000601
61.0259 (61)	0.035315	0.908102	33.8147 (34)	2.11342 (2)	1.05671 (1)	0.264178 ( $\frac{1}{4}$ )	1,000.027 (1,000)	1	0.001 ( $\frac{1}{1000}$ )
			Bushels						
67.230625 (67)	0.038889 ( $\frac{1}{25}$ )	1	0.03125 [ $\frac{1}{32}$ ]	-----	1.163647 (1 $\frac{1}{6}$ )	0.290912	1,101.23	1.101198	0.601 ( $\frac{1}{1000}$ )
2,150.42	1.24446 (1 $\frac{1}{4}$ )	32	81	-----	37.2367 (37)	9.309177 (9)	35,239.23	35.23833 (35)	0.03523 ( $\frac{1}{30}$ )
	35.3145 (35)	908.073 (910)	28.3774	-----	1,056.68 (1,000)	264.170 (265)	1,000,000 (1,000)	999.973 (1,000)	1

<sup>1</sup> 1 cubic yard=27 cubic feet=21.696 bushels=0.764559 m<sup>3</sup> (stere).

<sup>2</sup> 1 gill=7.21875 cubic inches=4 fluid ounces=0.25 [ $\frac{1}{4}$ ] liquid pint=0.125 [ $\frac{1}{8}$ ] liquid quart=0.03125 [ $\frac{1}{32}$ ] gallon=0.118292 liter.

<sup>3</sup> 1 cubic millimeter=0.001 cm<sup>3</sup>=0.000061 cubic inch.

<sup>4</sup> 1 liter=volume pure water at 4° C. and 760 mm pressure weighing 1 kg=0.028378 bushel=0.001308 cubic yard.

<sup>5</sup> 1 cubic foot=0.80356 bushel=0.037037 cubic yard.

<sup>6</sup> The British imperial gallon=10 pounds distilled water at 62° F. (and barometer at 30 inches)=277.418 cubic inches=1.20094 U. S. gallons=0.16054 cubic foot=4.545963 liters.

<sup>7</sup> 1 cubic centimeter=0.999973 milliliter (ml).

<sup>8</sup> The British imperial bushel=8 British gallons=2219.340 cubic inches=1.032050 United States bushels=36.37 liters.

<sup>9</sup> 1 m<sup>3</sup>=1.308 cubic yards.

TABLE 4.—*Weight; unit conversion factors, with approximate values*

Grains <sup>1</sup>	Avoirdupois weight <sup>2</sup>			Troy and apothecaries' weight			Metric system		
	Drams	Ounces	Pounds	Drams	Ounces	Pounds	Milli-grams	Grams	Kilo-grams
<b>1</b>	0.03657 ( $\frac{1}{27}$ )	0.002286	0.000143 [ $\frac{1}{7000}$ ]	0.016667 [ $\frac{1}{60}$ ]	0.002083 ( $\frac{1}{500}$ )	0.000174	64.7989 (65)	0.064799 ( $\frac{1}{15}$ )	-----
27.34375	<b>1</b>	0.0625 [ $\frac{1}{16}$ ]	0.003906 ( $\frac{1}{250}$ )	0.45573 ( $\frac{1}{2}$ )	0.056966	0.004747 ( $\frac{1}{210}$ )	-----	1.771845	-----
437.5 (440)	16	<sup>3</sup> <b>1</b> 0.0625 [ $\frac{1}{16}$ ]	0.0625 ( $\frac{1}{16}$ )	7.292	0.9115	0.075955 ( $\frac{1}{13}$ )	-----	28.34953 (28)	-----
7,000	256	16	<b>1</b>	116.667	14.5833 (14 $\frac{1}{2}$ )	1.21528 (1 $\frac{1}{5}$ )	-----	453.562 (450)	0.453592 ( $\frac{1}{2}$ )
60	2.194286 (2)	0.137143 ( $\frac{1}{4}$ )	0.008571	<b>1</b>	0.125 [ $\frac{1}{8}$ ]	0.010417 [ $\frac{1}{96}$ ]	-----	3.887935 (4)	-----
480	17.55429	1.09714 (1)	0.06857 ( $\frac{1}{15}$ )	8	<b>1</b>	0.083333 [ $\frac{1}{12}$ ]	-----	31.10348 (31)	-----
5,760	210.651	13.1657 (13)	0.822857 ( $\frac{4}{5}$ )	96	12	<b>1</b>	-----	373.2418 (375)	0.373242 ( $\frac{2}{5}$ )
0.015432 ( $\frac{1}{65}$ )	0.000564	-----	-----	0.000257	-----	-----	<sup>4</sup> <b>1</b>	0.001	-----
15.43236 (15)	0.564383	0.035274 ( $\frac{1}{28}$ )	0.002205	0.257206	0.032151 ( $\frac{1}{30}$ )	0.002679	1,000	<b>1</b>	0.001
	Hundred-weight			Short tons	Long tons		Milliers, tonnes, or metric tons		
	<b>1</b>	-----	100	0.05 [ $\frac{1}{20}$ ]	0.045 ( $\frac{1}{20}$ )	-----	0.045359 ( $\frac{1}{20}$ )	-----	45.35924 (45)
	20	-----	2,000	<b>1</b>	0.89286 ( $\frac{9}{10}$ )	-----	0.90718 ( $\frac{9}{10}$ )	-----	907.1849 (900)
	22.4	-----	2,240	1.12 (1 $\frac{1}{10}$ )	<b>1</b>	-----	1.01605 (1)	-----	1,016.05 (1,000)
	22.05	-----	2,204.62	1.102311 (1 $\frac{1}{10}$ )	0.984206	-----	<sup>5</sup> <b>1</b>	-----	1,000
15,432.4	0.022046	35.27396 (35)	2.204622 (2 $\frac{1}{5}$ )	0.001102	0.000984	2.679228 (2 $\frac{1}{2}$ )	0.001	1,000	<b>1</b>

<sup>1</sup> The grain is common to avoirdupois, troy, and apothecaries' systems.<sup>2</sup> British units include 1 hundredweight (long, or one-twentieth long ton)=4 quarters=8 stone=112 pounds=50.8 kg; 1 stone=14 pounds=6.35 kg.<sup>3</sup> 1 ounce (avoirdupois)=0.001 cubic foot of water at 16.7° C., or 62.06° F.<sup>4</sup> 1 metric carat=200 mg=3.086471 grains.<sup>5</sup> 1 tonne=10 quintals=100 myriagrams.TABLE 5.—*Velocity; unit conversion factors, with approximate values*

Feet per minute	Feet per second	Miles per hour	Knots per hour	Meters per minute	Meters per second	Kilometers per hour
<b>1</b>	0.016667 [ $\frac{1}{60}$ ]	0.011364 ( $\frac{1}{100}$ )	0.009868 ( $\frac{1}{100}$ )	0.304801 ( $\frac{1}{3}$ )	0.00508 ( $\frac{1}{200}$ )	0.018288 ( $\frac{1}{50}$ )
60	<b>1</b>	0.681818 ( $\frac{2}{3}$ )	0.592086 ( $\frac{3}{5}$ )	18.2880 (18)	0.304801 ( $\frac{1}{3}$ )	1.0973 (1.1)
88	1.46667 (1 $\frac{1}{2}$ )	<b>1</b>	0.868393 ( $\frac{7}{8}$ )	26.8225 (27)	0.447041 ( $\frac{1}{2}$ )	1.60935 (1 $\frac{3}{5}$ )
101.337 (100)	1.6894 (1 $\frac{2}{3}$ )	1.15155 (1 $\frac{1}{4}$ )	<b>1</b>	30.8875 (31)	0.514791 ( $\frac{1}{2}$ )	1.85325 (1 $\frac{7}{8}$ )
3.28083 (3 $\frac{1}{4}$ )	0.054681 ( $\frac{1}{20}$ )	0.037282 ( $\frac{1}{27}$ )	0.032376 ( $\frac{1}{30}$ )	<b>1</b>	0.016667 [ $\frac{1}{60}$ ]	0.06 ( $\frac{1}{17}$ )
196.850 (200)	3.28083 (3 $\frac{1}{4}$ )	2.236932 (2 $\frac{1}{4}$ )	1.94253 (2)	60	<b>1</b>	3.6
54.6806 (55)	0.911343 (1)	0.621370 ( $\frac{5}{8}$ )	0.539593 ( $\frac{1}{2}$ )	16.6667 (17)	0.27778 ( $\frac{1}{4}$ )	<b>1</b>



TABLE 6.—*Power; unit conversion factors, with approximate values*

Foot-pounds per minute	Foot-pounds per second	Watts	Kilogram-meters per second	Force de cheval	Horse-power	Kilowatt
<b>1</b>	0.01667 [ $\frac{1}{60}$ ]	0.0226 ( $\frac{1}{45}$ )	0.0023			
60	<b>1</b>	1.35582 ( $\frac{1}{3}$ )	0.138255	0.00184	0.00182	
44.2537 (45)	0.73756 ( $\frac{3}{4}$ )	<b>1</b>	0.101972 ( $\frac{1}{10}$ )	0.00136	0.00134	0.001
433.9799 (434)	7.23300	9.80665 (10)	<b>1</b>	0.01333	0.01315	0.0098
32,548.5	542.475	735.499	75	<b>2</b> <sup>1</sup>	0.98632 (1)	0.7355 ( $\frac{3}{4}$ )
33,000	550	745.7 (750)	76.04	1.01387 (1)	<b>1</b>	0.7457 ( $\frac{3}{4}$ )
44,253.7 (45,000)	737.56	1,030	101.972 (100)	1.3556 ( $\frac{1}{3}$ )	1.341 ( $\frac{1}{3}$ )	<b>1</b>

<sup>1</sup> 1 watt = 10<sup>7</sup> ergs per second = 1 joule per second.<sup>2</sup> 1 force de cheval = 1 metric horsepower.TABLE 7.—*Weight as applied to length; unit conversion factors, with approximate values*

Grains per inch	Pounds per yard	Pounds per foot	Pounds per inch	Grams per meter	Grams per centimeter	Kilograms per meter
<b>1</b>	0.005143 ( $\frac{1}{200}$ )			2.551137 ( $\frac{2}{3}$ )	0.02551 ( $\frac{1}{40}$ )	
194.444 (200)	<b>1</b>	0.333 [ $\frac{1}{3}$ ]	0.027778 [ $\frac{1}{36}$ ]	496.054 (500)	4.96054 (5)	0.496054 ( $\frac{1}{2}$ )
583.333 (600)	3	<b>1</b>	0.083333 [ $\frac{1}{12}$ ]	1488.16 (1500)	14.8816 (15)	1.48816 ( $\frac{1}{12}$ )
7,000	33	12	<b>1</b>		178.579 (180)	17.8579 (18)
0.391983 ( $\frac{2}{5}$ )	0.002016	0.000672	0.000056	<b>1</b>	0.01 [ $\frac{1}{100}$ ]	0.001 [ $\frac{1}{1000}$ ]
39.198 (40)	0.201591 ( $\frac{1}{5}$ )	0.067197 ( $\frac{1}{15}$ )	0.005600 ( $\frac{1}{200}$ )	100	<b>1</b>	0.1
391.9826 (400)	2.015911 (2)	0.67197 ( $\frac{2}{3}$ )	0.055398	1,000	10	<b>1</b>

<sup>1</sup> 1 gram per meter = 3.5489 pounds per mile = 1 kilogram per kilometer.TABLE 8.—*Weight or pressure as applied to area;<sup>1</sup> unit conversion factors, with approximate values*

Pounds per square foot	Pounds per square inch	Feet of water column or head <sup>2</sup>	Kilograms per square meter	Grams per square centimeter	Milli-meters of mercury column <sup>3</sup>	Atmospheres
<b>1</b>	0.006944 [ $\frac{1}{144}$ ]	0.016018 ( $\frac{1}{60}$ )	4.88241 (5)	0.488241 ( $\frac{1}{2}$ )		0.000473
144	<b>1</b>	2.306645	703.067	70.3067 (70)	51.7134	0.068044 ( $\frac{1}{15}$ )
62.4283	0.433530	<b>1</b>	304.801	30.4801 (22 $\frac{1}{2}$ )	22.4193 (22 $\frac{1}{2}$ )	0.029499 ( $\frac{3}{8}$ )
0.204817 ( $\frac{1}{5}$ )	0.001422	0.003281	<b>1</b>	0.1		0.0000963 ( $\frac{1}{10000}$ )
2.04817 (2)	0.01422 ( $\frac{1}{70}$ )	0.03281	10	<b>1</b>		0.000963
2.784578 (234)	0.019337 ( $\frac{1}{50}$ )	0.044604	<sup>6</sup> 13.59545 ( $\frac{1}{3}$ )	1.359545 ( $\frac{1}{3}$ )	<b>7</b> <sup>1</sup>	0.001316
2,116.28	14.6964 (147 $\frac{1}{10}$ )	33.8993	10,332.54	1,033.254	760	<b>1</b> <sup>8</sup>

<sup>1</sup> Pressure unit = 1 barye = 1 dyne per square centimeter = 0.0010197 gram per square centimeter = 0.0010197 kilogram per square meter = (approximately) 0.000001 atmosphere. <sup>1</sup> megadyne = 10<sup>6</sup> dynes per square centimeter = 0.980692 atmosphere.<sup>2</sup> At 4° C., or 39.2° F.<sup>3</sup> At 0° C., or 32° F. 1 inch of mercury column = 70.728 pounds per square foot = 1.132954 feet of water = 345.325 kilograms per square meter = 25.40005 millimeters of mercury = 0.033421 atmosphere.<sup>4</sup> 1 pound per square inch = 0.072 ton per square foot.<sup>5</sup> 1 foot of water = 0.882648 inch of mercury = 0.304801 meter of water.<sup>6</sup> The specific gravity of mercury at 0° C.<sup>7</sup> 1 millimeter of mercury = 0.03937 inch of mercury = 0.013595 meter of water.<sup>8</sup> 1 atmosphere = 29.9212 inches of mercury = 10.332542 meters of water.

TABLE 9.—*Weight as applied to volume; unit conversion factors, with approximate values*

Grains per cubic inch	Pounds per cubic yard	Pounds per bushel	Pounds per cubic foot	Pounds per gallon	Kilograms per cubic meter	Grams per cubic centimeter
<b>1</b>		0.307203	0.246857 ( $\frac{1}{4}$ )	0.0330 ( $\frac{1}{30}$ )	3.95425 (4)	0.003954 ( $\frac{1}{250}$ )
	<b>1</b>		0.037037 [ $\frac{1}{27}$ ]		0.593273 ( $\frac{3}{5}$ )	0.000593 ( $\frac{1}{168}$ )
3.25518 ( $\frac{3}{4}$ )		<b>1</b>	0.803564 ( $\frac{3}{5}$ )	0.107421 ( $\frac{1}{10}$ )	12.8718 (13)	0.012872
4.05093 (4)	27	1.24446 ( $\frac{1}{4}$ )	<b>1</b>	0.133681 ( $\frac{1}{7}$ )	16.0184 (16)	0.016018 ( $\frac{1}{60}$ )
30.3030 (30)		9.3092 (9 $\frac{1}{2}$ )	7.48052 (7 $\frac{1}{2}$ )	<b>1</b>	119.826 (120)	0.119826 ( $\frac{1}{8}$ )
	1.68556 ( $1\frac{1}{3}$ )	0.077689	0.062428 ( $\frac{1}{16}$ )	0.008345 ( $\frac{1}{120}$ )	<b>1</b>	0.001
252.893 (250)	1,685.56 (1,700)	77.6893 (80)	62.4283 (62 $\frac{1}{2}$ )	8.34545 (8)	1,000	<b>1</b>

<sup>1</sup> 1 pound per cubic foot=1.60188 kilograms per hectoliter=0.0135 ton per cubic yard.

<sup>2</sup> 1 pound per gallon=0.1198 kilogram per liter.

<sup>3</sup> 1 gram per cubic centimeter=1 tonne (metric ton) per cubic meter=(approximately) 1 kilogram per liter.

TABLE 10.—*Volume of various units of weight of water, with approximate values*

Unit of weight	Volume of various units of weight in—					
	Cubic centimeters	Cubic inches	Pints (liquid)	Quarts (liquid)	Liters	Gallons
1 grain	0.034799 ( $\frac{1}{15}$ )	0.003954 ( $\frac{1}{250}$ )				
1 ounce	23.3495 (23)	1.72098 ( $\frac{1}{4}$ )	0.059913 ( $\frac{1}{16}$ )	0.029956 ( $\frac{1}{32}$ )	0.028349 ( $\frac{1}{36}$ )	0.007489 ( $\frac{1}{13}$ )
1 pound	453.592 (450)	27.6797 (28)	0.958603 (1)	0.479303 ( $\frac{1}{2}$ )	0.453580 ( $\frac{1}{2}$ )	0.119826 ( $\frac{1}{8}$ )
1 gram	<b>1</b>	0.061023 ( $\frac{1}{16}$ )				
1 kilogram	1,000	61.0234 (60)	2.11336 (2)	1.05668 (1)	<b>1</b>	0.264170 ( $\frac{1}{4}$ )
1 short ton					907.160	239.652 (240)
1 metric ton <sup>2</sup>					<b>1</b> 1000	264.170

Unit of weight	Volume of various units of weight in—				
	Cubic feet	Bushels	Hectoliters	Cubic yards	Cubic meters
1 ounce	<b>1</b> 0.001				
1 pound	0.016018 ( $\frac{1}{60}$ )	0.012872 ( $\frac{1}{80}$ )			
1 kilogram	0.035314 ( $\frac{1}{28}$ )	0.028377 ( $\frac{1}{35}$ )	<b>1</b> 0.01	0.001308	0.001
1 short ton	32.0367 (32)	25.7436 (26)	9.07160 (9)	1.18655 ( $\frac{1}{8}$ )	0.907185 (.9)
1 metric ton <sup>2</sup>	35.3145 (35)	28.3774 (28)	<b>1</b> 10	1.30794 ( $\frac{1}{8}$ )	<b>1</b>

<sup>1</sup> Water has its greatest density at 4° C. and 760 millimeter pressure. At this density, 1 liter of water weighs 0.999973 kilogram. This value was used in the conversion here presented. For all practical forestry purposes, a liter of water can be considered as weighing 1 kilogram. Similarly, 0.001 cubic foot of water is considered as weighing 1 ounce. This density is attained at 16.7° C.

<sup>2</sup> Metric ton=1.1023112 short tons.

TABLE 11.—*Weight of various units of volume of water, with approximate values*

Unit of volume	Weight of various units of volume in—				
	Grains	Ounces	Pounds	Grams	Kilograms
1 cubic centimeter .....	15. 4324 (15½) 252. 893 (250)	0. 035274 (⅓) 0. 578040 (⅝)	0. 002205 (⅓) 1. 04318 (1)	1 (16)	0. 001 (⅓) 0. 473179 (½)
1 cubic inch .....					
1 pint (liquid) .....		16. 6909 (33)	2. 08639 (2)		0. 946359 (1)
1 quart (liquid) .....		33. 3818 (35)	2. 20468 (2½)	1 1, 000	1 (1)
1 liter .....		35. 2749 (35)	8. 34545 (8)		3. 78543 (4)
1 gallon .....		133. 527 (135)			
	Short tons			Metric tons	
1 cubic foot .....	0. 031214 (⅓)	2 1, 000	62. 4283 (62½)	0. 028317 (⅓)	28. 3170 (28)
1 bushel .....	0. 038845 (⅓)		77. 6893 (80)	0. 035239 (⅓)	35. 2393 (⅓)
1 hectoliter .....	0. 110234 (⅓)		220. 468 (220)	1 0. 1	1 100
1 cubic yard .....	0. 842782 (⅓)		1, 685. 56 (1, 700)	0. 764559	764. 559
1 cubic meter .....	3 1. 10234		2, 204. 62 (2200)	1	1, 000

<sup>1</sup> A liter is, by definition, a unit of capacity equivalent to the volume occupied by the mass of a kilogram of pure water at its maximum density (4°C.) and under a pressure of 760 mm. It is actually equivalent in volume to 1.000027 cubic decimeters. In forestry measurements, however, 1 liter is considered as weighing 1 kilogram and having a volume of 1 cubic decimeter.

<sup>2</sup> In forestry measurements, the weight of 1 cubic foot is taken as 1,000 ounces. The absolute value is 998.853 ounces.

<sup>3</sup> Approximately 1 long ton.

TABLE 12.—*Rainfall per unit area; equivalent measurements*

Unit of rainfall	In cubic inches	In gallons	In cubic feet	In short tons	In liters	In metric tons
1 inch per acre .....	6, 272. 640	27. 154	3, 630	113. 3	102, 788. 0	102. 8
1 millimeter per hectare .....	610. 234	2, 642	353	11. 0	1 10, 000	10
1 millimeter per acre .....	246. 954	1, 069	143	4. 5	4, 076. 76	4. 0

<sup>1</sup> 9,999.73.

TABLE 13.—*Reservoir capacity, in equivalent measurements*

Acre-foot <sup>1</sup>	Gallons	Cubic feet	Cubic yards	Cubic meters
1	325, 851	43, 560	1, 613. 33	1, 233. 49

<sup>1</sup> The volume of a prism 1 foot high with a base of 1 acre.

TABLE 14.—*Discharge or flow of water; unit conversion factors, with approximate values*

Cubic feet per minute	Gallons per second	Cubic feet per second (second-foot)	Acre-feet per hour	Miner's inch <sup>1</sup>	Liters per second	Cubic meters per second
<b>1</b>	0.124675 ( $\frac{1}{8}$ )	0.01667 ( $\frac{1}{60}$ )	0.001377	0.667 ( $\frac{2}{3}$ )	0.471938 ( $\frac{1}{2}$ )	-----
8.02083 (8)	<b>1</b>	0.123381 ( $\frac{1}{8}$ )	0.01105 ( $\frac{1}{90}$ )	-----	3.78533 (3 $\frac{3}{4}$ )	0.003785 ( $\frac{1}{250}$ )
60	7.48052 (7 $\frac{1}{2}$ )	<b>1</b>	<sup>2</sup> 0.082645 ( $\frac{1}{12}$ )	40	28.3163 (28)	0.028317 ( $\frac{1}{36}$ )
726	90.5143 (90)	12.1 (12)	<b>1</b>	484 (500)	342.627 (350)	0.342636 ( $\frac{1}{3}$ )
1.5 [1 $\frac{1}{2}$ ]	0.187013 ( $\frac{1}{5}$ )	0.025 ( $\frac{1}{40}$ )	0.002066	<b>1</b>	0.707906	-----
2.11892 (2)	0.264178 ( $\frac{1}{4}$ )	0.035315 ( $\frac{1}{30}$ )	0.002919	-----	<b>1</b>	<sup>3</sup> 0.001
2,118.87 (2000)	264.170 (265)	35.3145 (35)	2.91855 (3)	-----	999.973 (1000)	<b>1</b>

<sup>1</sup> Approximate values only; the miner's inch, used in many Western States to measure water flow, is the quantity of water that will pass through an orifice 1 square inch in cross-section under a given head, and varies from 1.36 to 1.73 cubic feet per minute. In California the legal standard is 1.5 cubic feet per minute, or the flow through an aperture 2 inches high in a 1.25-inch plank under a 6-inch head above the center of the stream.

<sup>2</sup> Or 1.98347 (approximately 2) acre-feet per day.

<sup>3</sup> See footnote 1, table 11.

TABLE 15.—*Approximate quantities of forest products represented by 1,000 feet of timber board measure (1 M feet b. m.)*

Product	Quantity	Product	Quantity
Shingles.....	10,000	Fence posts.....	202
Lath.....	5,000	Round timber (ratio, 6:1) cubic feet.....	166.667
Hoops.....	3,000	Sawed material (ratio, 12:1) cubic feet.....	83.333
Slack staves.....	3,000	Poles (telephone).....	16.667
Tight staves.....	1,000	Stercs (m <sup>3</sup> ).....	7.25
Slack heading, sets.....	500	Cords.....	0
Tight heading, sets.....	250		

TABLE 16.—*Approximate <sup>1</sup> equivalents of forest products*

Cubic feet	Board feet	Cords	Cubic meters (steres)
1.....	<sup>2</sup> 6	-----	0.0283
200 <sup>3</sup> .....	1,000	2	7.25
90 <sup>4</sup> .....	500	1	2.5
35.....	138	0.25	1

<sup>1</sup> Most of these volumetric units are not capable of absolute conversion because of the character of the product and the manner of its utilization.

<sup>2</sup> The board foot per cubic foot ratio varies greatly, depending upon usage. Theoretically, 1 cubic foot contains 12 board feet. For average values 6 should be used, though 10 is a convenient figure for approximations. When the conversion applies to trees, ratios of 3 to 8 should be applied.

<sup>3</sup> The number of cubic feet of wood per thousand board feet varies as between softwoods and hardwoods. In softwoods, conversion factors vary from 160 to 220 cubic feet (working average about 183), and in hardwoods, from 220 to 250 (working average 242).

<sup>4</sup> Standard cord is 4 by 4 by 8 feet and contains 128 cubic feet gross volume (3.625m<sup>3</sup>). Because of methods of piling, character of material, etc., a cord of wood contains from 75 to 115 cubic feet. 90 cubic feet is taken as a rough conversion figure generally applicable.

TABLE 17.—Areas of squares, length of one side being given <sup>1</sup>

Length of each side of square			Area of square		
Feet	Meters	Chains	Square feet	Acres	Hectares
0.66	0.201	<b>0.01</b>	0.4356	0.00001	-----
3.28	<b>1</b>	.050	10.76	.00025	0.0001
6.56	<b>2</b>	.099	43.06	.00099	.0004
6.6	2.012	<b>1</b>	43.56	<sup>2</sup> .001	.0004
9.84	<b>3</b>	.149	96.87	.00222	.0009
<b>10</b>	3.048	.152	100	.00230	.0009
13.1	<b>4</b>	.199	172.22	.00395	.0016
13.2	4.023	<b>2</b>	174.24	.004	.0016
<b>15</b>	4.572	.227	225	.00517	.0021
16.4	<b>5</b>	.249	269.10	.00618	.0025
16.5	5.029	<b>25</b>	272.25	.00625	.0025
19.7	<b>6</b>	.298	387.50	.00890	.0036
19.8	6.035	<b>3</b>	392.04	.009	.0036
<b>20</b>	6.096	.303	400	.00918	.0037
23.0	<b>7</b>	.348	527.43	.01211	.0049
<b>25</b>	7.620	.379	625	.01435	.0058
26.2	<b>8</b>	.398	688.80	.01581	.0064
26.4	8.047	<b>4</b>	696.96	.016	.0065
29.5	<b>9</b>	.447	871.87	.02002	.0081
<b>30</b>	9.144	.455	900	.02066	.0084
32.8	<b>10</b>	.497	1,076.39	.02471	.01
33	10.058	<b>5</b>	1,089	.025	.0101
<b>35</b>	10.668	.530	1,225	.02812	.0114
39.6	12.070	<b>6</b>	1,568.16	.036	.0146
<b>40</b>	12.192	.606	1,600	.03673	.0149
45	13.716	.682	2,025	.04649	.0188
46.2	14.082	<b>7</b>	2,134.44	.049	.0198
49.5	15.088	<b>75</b>	2,450.25	.05625	.0228
<b>50</b>	15.240	.758	2,500	.05739	.0232
52.8	16.093	<b>8</b>	2,787.84	.064	.0250
<b>55</b>	16.764	.833	3,025	.06944	.0281
59.4	18.105	<b>9</b>	3,528.36	.081	.0328
<b>65</b>	19.812	.985	4,225	.09599	.0393
65.6	<b>20</b>	.994	4,305.55	.09884	.04
66	20.117	<b>1</b>	4,356	.1	.0405
<b>70</b>	21.336	1.061	4,900	.11249	.0455
<b>75</b>	22.860	1.136	5,625	.12913	.0523
<b>80</b>	24.384	1.212	6,400	.14692	.0595
82.5	25.146	<b>1.25</b>	6,806.25	.15625	.0632
<b>85</b>	25.908	1.288	7,225	.16586	.0671
<b>90</b>	27.432	1.364	8,100	.18595	.0753
<b>95</b>	28.956	1.439	9,025	.20719	.0833
98.4	<b>30</b>	1.491	9,687.48	.22239	.09
99	30.175	<b>1.5</b>	9,801	.225	.0911
<b>100</b>	30.480	1.515	10,000	.22957	.0929
104.4	31.808	1.581	10,890	<b>.25</b>	.1012
115.5	35.204	<b>1.75</b>	13,340.25	.30625	.1259
131.2	<b>40</b>	1.988	17,222.19	.39537	.16
132	40.234	<b>2</b>	17,424	.4	.1619
147.6	44.985	2.236	21,780	<b>.5</b>	.2023
148.5	45.263	<b>2.25</b>	22,052.25	.50625	.2049
164	<b>50</b>	2.485	26,909.67	.61776	.25
165	50.292	<b>2.5</b>	27,225	.625	.2529
196.8	<b>60</b>	2.983	38,749.92	.88958	.36
198	60.351	<b>3</b>	39,204	.9	.3642
<b>200</b>	60.960	3.030	40,000	.91827	.3716
208.7	63.615	3.162	43,560	<b>1</b>	.4047
229.7	<b>70</b>	3.480	52,742.95	1.21081	.49
231	70.409	<b>3.5</b>	53,361	1.225	.4957
262.5	<b>80</b>	3.977	68,888.75	1.58147	.64
264	80.467	<b>4</b>	69,696	1.6	.6475
295.3	<b>90</b>	4.474	87,187.33	2.00155	.81
297	90.526	<b>4.5</b>	88,209	2.025	.8195
328.1	<b>100</b>	4.971	107,638.7	2.47104	1
330	100.584	<b>5</b>	108,900	2.5	1.0117

<sup>1</sup> The value in heavier type is that from which the corresponding values were computed. Continuing decimals or rounded values not shown in this table.<sup>2</sup> 1 milacre.

TABLE 18.—*Basal area in square feet from given diameters of 0.1 to 60 inches*<sup>1</sup>

Diameter, inches	Area of circle	Diameter, inches	Area of circle	Diameter, inches	Area of circle	Diameter, inches	Area of circle
	<i>Sq. ft.</i>		<i>Sq. ft.</i>		<i>Sq. ft.</i>		<i>Sq. ft.</i>
0.1	0.0001	7.9	0.3404	15.7	1.3444	23.5	3.0121
0.2	.0002	8	.3491	15.8	1.3616	23.6	3.0377
0.3	.0005	8.1	.3578	15.9	1.3789	23.7	3.0635+
0.4	.0009	8.2	.3667	16	1.3963	23.8	3.0895
0.5	.0014	8.3	.3757	16.1	1.4138	23.9	3.1155
0.6	.0020	8.4	.3848	16.2	1.4314	24	3.1416
0.7	.0027	8.5	.3941	16.3	1.4491	24.1	3.1678
0.8	.0035	8.6	.4034	16.4	1.4669	24.2	3.1942
0.9	.0044	8.7	.4128	16.5	1.4849	24.3	3.2206
1	.0055	8.8	.4224	16.6	1.5029	24.4	3.2472
1.1	.0066	8.9	.4320	16.7	1.5211	24.5	3.2739
1.2	.0079	9	.4418	16.8	1.5394	24.6	3.3006
1.3	.0092	9.1	.4517	16.9	1.5578	24.7	3.3275+
1.4	.0107	9.2	.4616	17	1.5763	24.8	3.3545+
1.5	.0123	9.3	.4717	17.1	1.5948	24.9	3.3816
1.6	.0140	9.4	.4819	17.2	1.6136	25	3.4088
1.7	.0158	9.5	.4922	17.3	1.6324	25.1	3.4362
1.8	.0177	9.6	.5027	17.4	1.6513	25.2	3.4636
1.9	.0197	9.7	.5132	17.5	1.6703	25.3	3.4911
2	.0218	9.8	.5238	17.6	1.6895	25.4	3.5188
2.1	.0241	9.9	.5346	17.7	1.7087	25.5	3.5466
2.2	.0264	10	.5454	17.8	1.7281	25.6	3.5744
2.3	.0289	10.1	.5564	17.9	1.7476	25.7	3.6024
2.4	.0314	10.2	.5675	18	1.7671	25.8	3.6305+
2.5	.0341	10.3	.5786	18.1	1.7868	25.9	3.6587
2.6	.0369	10.4	.5899	18.2	1.8066	26	3.6870
2.7	.0398	10.5	.6013	18.3	1.8265+	26.1	3.7154
2.8	.0428	10.6	.6128	18.4	1.8466	26.2	3.7439
2.9	.0459	10.7	.6244	18.5	1.8667	26.3	3.7726
3	.0491	10.8	.6362	18.6	1.8869	26.4	3.8013
3.1	.0524	10.9	.6480	18.7	1.9073	26.5	3.8302
3.2	.0559	11	.6600	18.8	1.9277	26.6	3.8591
3.3	.0594	11.1	.6720	18.9	1.9483	26.7	3.8882
3.4	.0631	11.2	.6842	19	1.9689	26.8	3.9174
3.5	.0668	11.3	.6964	19.1	1.9897	26.9	3.9467
3.6	.0707	11.4	.7088	19.2	2.0106	27	3.9761
3.7	.0747	11.5	.7213	19.3	2.0316	27.1	4.0056
3.8	.0788	11.6	.7339	19.4	2.0527	27.2	4.0352
3.9	.0830	11.7	.7466	19.5	2.0739	27.3	4.0649
4	.0873	11.8	.7594	19.6	2.0953	27.4	4.0948
4.1	.0917	11.9	.7724	19.7	2.1167	27.5	4.1247
4.2	.0962	12	.7854	19.8	2.1382	27.6	4.1548
4.3	.1008	12.1	.7985+	19.9	2.1599	27.7	4.1849
4.4	.1056	12.2	.8118	20	2.1817	27.8	4.2152
4.5	.1104	12.3	.8252	20.1	2.2035+	27.9	4.2456
4.6	.1154	12.4	.8386	20.2	2.2255+	28	4.2761
4.7	.1205	12.5	.8522	20.3	2.2476	28.1	4.3067
4.8	.1257	12.6	.8659	20.4	2.2698	28.2	4.3374
4.9	.1310	12.7	.8797	20.5	2.2921	28.3	4.3682
5	.1364	12.8	.8936	20.6	2.3145+	28.4	4.3991
5.1	.1419	12.9	.9076	20.7	2.3371	28.5	4.4301
5.2	.1475	13	.9218	20.8	2.3597	28.6	4.4613
5.3	.1532	13.1	.9360	20.9	2.3824	28.7	4.4925+
5.4	.1590	13.2	.9503	21	2.4053	28.8	4.5239
5.5	.1650	13.3	.9648	21.1	2.4282	28.9	4.5554
5.6	.1710	13.4	.9793	21.2	2.4513	29	4.5869
5.7	.1772	13.5	.9940	21.3	2.4745	29.1	4.6186
5.8	.1835	13.6	1.0088	21.4	2.4978	29.2	4.6504
5.9	.1899	13.7	1.0237	21.5	2.5212	29.3	4.6823
6	.1963	13.8	1.0387	21.6	2.5447	29.4	4.7144
6.1	.2029	13.9	1.0538	21.7	2.5683	29.5	4.7465
6.2	.2097	14	1.0690	21.8	2.5920	29.6	4.7787
6.3	.2165	14.1	1.0843	21.9	2.6159	29.7	4.8111
6.4	.2234	14.2	1.0998	22	2.6398	29.8	4.8435+
6.5	.2304	14.3	1.1153	22.1	2.6639	29.9	4.8761
6.6	.2376	14.4	1.1310	22.2	2.6880	30	4.9087
6.7	.2448	14.5	1.1467	22.3	2.7123	30.1	4.9415+
6.8	.2522	14.6	1.1626	22.4	2.7367	30.2	4.9744
6.9	.2597	14.7	1.1786	22.5	2.7612	30.3	5.0074
7	.2673	14.8	1.1947	22.6	2.7858	30.4	5.0405+
7.1	.2749	14.9	1.2109	22.7	2.8105	30.5	5.0737
7.2	.2827	15	1.2272	22.8	2.8353	30.6	5.1071
7.3	.2907	15.1	1.2436	22.9	2.8602	30.7	5.1405
7.4	.2987	15.2	1.2601	23	2.8852	30.8	5.1740
7.5	.3068	15.3	1.2768	23.1	2.9104	30.9	5.2077
7.6	.3150	15.4	1.2935+	23.2	2.9356	31	5.2414
7.7	.3234	15.5	1.3104	23.3	2.9610	31.1	5.2753
7.8	.3318	15.6	1.3273	23.4	2.9865	31.2	5.3093

<sup>1</sup>  $\pi = 3.1415926536$ ; basal area in sq. ft. =  $0.00545415391$  ( $0.005454154$ ) times the square of the diameter in inches.

TABLE 18.—*Basal area in square feet from given diameters of 0.1 to 60 inches—*  
Continued

Diameter, inches	Area of circle	Diameter, inches	Area of circle	Diameter, inches	Area of circle	Diameter, inches	Area of circle
	<i>Sq. ft.</i>		<i>Sq. ft.</i>		<i>Sq. ft.</i>		<i>Sq. ft.</i>
31.3	5.3434	38.5	8.0844	45.7	11.3909	52.9	15.2630
31.4	5.3776	38.6	8.1265	45.8	11.4409	53	15.3207
31.5	5.4119	38.7	8.1686	45.9	11.4909	53.1	15.3786
31.6	5.4463	38.8	8.2109	46	11.5410	53.2	15.4366
31.7	5.4808	38.9	8.2533	46.1	11.5912	53.3	15.4947
31.8	5.5155	39	8.2958	46.2	11.6416	53.4	15.5528
31.9	5.5502	39.1	8.3384	46.3	11.6920	53.5	15.6112
32	5.5851	39.2	8.3811	46.4	11.7426	53.6	15.6696
32.1	5.6200	39.3	8.4239	46.5	11.7932	53.7	15.7281
32.2	5.6551	39.4	8.4668	46.6	11.8440	53.8	15.7867
32.3	5.6903	39.5	8.5098	46.7	11.8949	53.9	15.8455
32.4	5.7256	39.6	8.5530	46.8	11.9459	54	15.9043
32.5	5.7610	39.7	8.5962	46.9	11.9970	54.1	15.9633
32.6	5.7965	39.8	8.6396	47	12.0482	54.2	16.0223
32.7	5.8321	39.9	8.6831	47.1	12.0995+	54.3	16.0815+
32.8	5.8678	40	8.7266	47.2	12.1510	54.4	16.1408
32.9	5.9036	40.1	8.7703	47.3	12.2025+	54.5	16.2002
33	5.9396	40.2	8.8141	47.4	12.2542	54.6	16.2597
33.1	5.9756	40.3	8.8580	47.5	12.3059	54.7	16.3193
33.2	6.0118	40.4	8.9021	47.6	12.3578	54.8	16.3790
33.3	6.0481	40.5	8.9462	47.7	12.4098	54.9	16.4389
33.4	6.0844	40.6	8.9904	47.8	12.4619	55	16.4988
33.5	6.1209	40.7	9.0348	47.9	12.5141	55.1	16.5589
33.6	6.1575+	40.8	9.0792	48	12.5664	55.2	16.6190
33.7	6.1942	40.9	9.1238	48.1	12.6188	55.3	16.6793
33.8	6.2310	41	9.1684	48.2	12.6713	55.4	16.7397
33.9	6.2680	41.1	9.2132	48.3	12.7239	55.5	16.8002
34	6.3050	41.2	9.2581	48.4	12.7767	55.6	16.8608
34.1	6.3421	41.3	9.3031	48.5	12.8295+	55.7	16.9215
34.2	6.3794	41.4	9.3482	48.6	12.8825	55.8	16.9823
34.3	6.4168	41.5	9.3934	48.7	12.9356	55.9	17.0432
34.4	6.4542	41.6	9.4387	48.8	12.9887	56	17.1042
34.5	6.4918	41.7	9.4842	48.9	13.0420	56.1	17.1654
34.6	6.5295	41.8	9.5297	49	13.0954	56.2	17.2266
34.7	6.5673	41.9	9.5754	49.1	13.1489	56.3	17.2880
34.8	6.6052	42	9.6211	49.2	13.2025+	56.4	17.3494
34.9	6.6432	42.1	9.6670	49.3	13.2563	56.5	17.4110
35	6.6813	42.2	9.7130	49.4	13.3101	56.6	17.4727
35.1	6.7196	42.3	9.7591	49.5	13.3640	56.7	17.5345+
35.2	6.7579	42.4	9.8053	49.6	13.4181	56.8	17.5964
35.3	6.7964	42.5	9.8516	49.7	13.4723	56.9	17.6584
35.4	6.8349	42.6	9.8980	49.8	13.5265+	57	17.7205+
35.5	6.8736	42.7	9.9445+	49.9	13.5809	57.1	17.7828
35.6	6.9124	42.8	9.9911	50	13.6354	57.2	17.8451
35.7	6.9513	42.9	10.0379	50.1	13.6900	57.3	17.9076
35.8	6.9903	43	10.0847	50.2	13.7447	57.4	17.9701
35.9	7.0294	43.1	10.1317	50.3	13.7995+	57.5	18.0328
36	7.0686	43.2	10.1788	50.4	13.8544	57.6	18.0956
36.1	7.1079	43.3	10.2259	50.5	13.9095	57.7	18.1585
36.2	7.1473	43.4	10.2732	50.6	13.9646	57.8	18.2215
36.3	7.1869	43.5	10.3206	50.7	14.0198	57.9	18.2846
36.4	7.2265+	43.6	10.3681	50.8	14.0752	58	18.3478
36.5	7.2663	43.7	10.4157	50.9	14.1307	58.1	18.4111
36.6	7.3062	43.8	10.4635	51	14.1863	58.2	18.4745+
36.7	7.3461	43.9	10.5113	51.1	14.2419	58.3	18.5381
36.8	7.3862	44	10.5592	51.2	14.2977	58.4	18.6017
36.9	7.4264	44.1	10.6073	51.3	14.3536	58.5	18.6655
37	7.4667	44.2	10.6555	51.4	14.4097	58.6	18.7293
37.1	7.5072	44.3	10.7037	51.5	14.4658	58.7	18.7933
37.2	7.5477	44.4	10.7521	51.6	14.5220	58.8	18.8574
37.3	7.5883	44.5	10.8006	51.7	14.5784	58.9	18.9216
37.4	7.6291	44.6	10.8492	51.8	14.6348	59	18.9859
37.5	7.6699	44.7	10.8979	51.9	14.6914	59.1	19.0503
37.6	7.7109	44.8	10.9467	52	14.7480	59.2	19.1148
37.7	7.7519	44.9	10.9956	52.1	14.8048	59.3	19.1795
37.8	7.7931	45	11.0447	52.2	14.8617	59.4	19.2442
37.9	7.8344	45.1	11.0938	52.3	14.9187	59.5	19.3091
38	7.8758	45.2	11.1431	52.4	14.9758	59.6	19.3740
38.1	7.9173	45.3	11.1924	52.5	15.0330	59.7	19.4391
38.2	7.9589	45.4	11.2419	52.6	15.0903	59.8	19.5043
38.3	8.0005	45.5	11.2915	52.7	15.1478	59.9	19.5696
38.4	8.0425	45.6	11.3411	52.8	15.2053	60	19.6350

TABLE 19.—*Area of large circles* <sup>1</sup>

Diameter	Area		Diameter	Area		Diameter	Area	
	Square feet <sup>2</sup>	Acres		Square feet <sup>2</sup>	Acres		Square feet <sup>2</sup>	Acres
10	78.5	0.0018	37-3	1,089	0.025	100	7,854	0.180
11-3	100.	.0023	50	1,963	.045	105-4	8,712	.2
12	113.1	.0026	52-8	2,178	.05	117-9	10,890	.25
15	176.7	.0041	55-5	2,500	.057	129	13,068	.3
16	201.1	.0046	60	2,827	.065	135	14,520	.33 <sup>1</sup> / <sub>3</sub>
20	314.2	.0072	61-10	3,000	.069	138-2	15,000	.34
22-7	400.	.0092	64-6	3,267	.075	148-11	17,424	.4
23-7	436	.010	68	3,421	.079	159-7	20,000	.46
25	491	.011	71-4	4,000	.092	166-6	21,780	.5
25-3	560	.011	74-6	4,356	.1	203-11	32,670	.75
30	707	.016	75	4,418	.101	235-6	43,560	1.
35-8	1,000	.023	79-9	5,000	.115			

<sup>1</sup> The value in heavier type is that from which the corresponding values were computed.<sup>2</sup> Area in square feet=diameter in feet squared multiplied by 0.785398163.TABLE 20.—*Number of trees per acre by various methods of spacing*

Spacing (feet)	Trees	Spacing (feet)	Trees	Spacing (feet)	Trees
	Number		Number		Number
2×2	10,800	7×9	691	12×15	242
3×3	4,840	7×10	622	12×18	202
4×4	2,722	7×12	519	12×20	182
4×5	2,178	7×15	415	12×25	145
4×6	1,815	8×8	681	13×13	258
4×7	1,553	8×9	605	13×15	223
4×8	1,361	8×10	544	13×20	158
4×9	1,210	8×12	454	13×25	134
4×10	1,089	8×15	363	14×14	222
5×5	1,742	8×25	218	14×15	207
5×6	1,452	9×9	538	14×20	156
5×7	1,245	9×10	484	14×25	124
5×8	1,089	9×12	403	15×15	194
5×9	938	9×15	323	15×20	145
5×10	871	10×10	436	15×25	116
6×6	1,210	10×12	363	16×16	170
6×7	1,037	10×15	290	16×20	136
6×8	908	10×18	242	16×25	109
6×9	807	11×11	360	18×18	134
6×10	726	11×12	330	18×20	121
6×12	605	11×15	254	18×25	97
6×15	484	11×20	198	20×20	109
7×7	889	11×25	158	20×25	87
7×8	778	12×12	302	25×25	70

TABLE 21.—*Grades and slopes per 100 feet horizontal* <sup>1</sup>

GRADE PERCENT AND EQUIVALENT DEGREE OF SLOPE

Grade (Percent)	Slope in degrees	Grade (Percent)	Slope in degrees	Grade (Percent)	Slope in degrees	Grade (Percent)	Slope in degrees
	° ' "		° ' "		° ' "		° ' "
1	0 34.4	11	6 16.6	21	11 51.6	55	28 43.6
2	1 8.7	12	6 50.6	22	12 24.4	60	30 57.8
3	1 43.1	13	7 24.4	23	12 57.2	65	33 1.4
4	2 17.4	14	7 58.2	24	13 29.7	70	34 59.5
5	2 51.7	15	8 31.8	25	14 2.2	75	36 52.2
6	3 26.0	16	9 5.4	30	16 42.0	80	38 39.6
7	4 0.3	17	9 38.9	35	19 17.4	85	40 21.9
8	4 34.4	18	10 12.2	40	21 48.1	90	41 59.2
9	5 8.6	19	10 45.5	45	24 13.7	95	43 31.9
10	5 42.6	20	11 18.6	50	26 33.9	100	45 0

<sup>1</sup> Equivalents of customary expressions of grade are as follows:

Grades and slopes: 1 foot per chain=1.515 percent; 1 foot per mile=0.019329 percent; 1 millimeter per meter=0.1 percent; 1 foot per thousand=0.1 percent; 1-percent grade=633.6 inches per mile=52.8 feet per mile=10 millimeters per meter=10 feet per thousand feet=1 foot per 1.515 chains=0.66 feet per chain.



TABLE 21.—*Grades and slopes per 100 feet horizontal*—Continued

DEGREE OF SLOPE AND EQUIVALENT GRADE PERCENT

Degree of slope	Grade	Degree of slope	Grade	Degree of slope	Grade	Degree of slope	Grade
° ' 0 30	Percent 0.873	° ' 5	Percent 8.749	° ' 9 30	Percent 16.734	° ' 18	Percent 32.492
1	1.746	5 30	9.629	10	17.633	19	34.433
1 30	2.619	6	10.510	11	19.438	20	36.397
2	3.492	6 30	11.394	12	21.256	22 30	41.421
2 30	4.366	7	12.278	13	23.087	25	46.631
3	5.241	7 30	13.165	14	24.933	30	57.735
3 30	6.116	8	14.054	15	26.795	35	70.021
4	6.993	8 30	14.945	16	28.675	40	83.910
4 30	7.870	9	15.838	17	30.573	45	100.0

TABLE 22.—*Ratios for customary map scales*

Scale 1 to—	Inches per mile	Miles per inch	Feet per inch	Meters per inch	Feet per $\frac{1}{32}$ inch
600	105.6	0.00947	50	15.2	2
1,200	52.8	.01894	100	30.5	4
2,500	25.344	.03946	208	63.5	8.3
4,800	13.2	.07576	400	121.9	16
5,280	12	.08333	440	134.1	17.6
10,000	6.336	.15783	833	254.0	33.3
12,000	5.28	.18939	1,000	304.8	40
21,120	3	.33333	1,760	536.4	70.4
31,680	2	.5	2,640	804.7	105.6
45,000	1.408	.71023	3,750	1,143.0	150
62,500	1.014	.98643	5,280	1,587.5	208.3
63,360	1	1	5,280	1,609.3	211.2
90,000	.704	1.4205	7,500	2,286.0	300
96,000	.66	1.5152	8,000	2,438.4	320
125,000	.507	1.9729	10,417	3,175.0	416.7
500,000	.127	7.8914	41,667	12,700.0	1,666.7
1,000,000	.063	15.7828	83,333	25,400.1	3,333.3
2,500,000	.025	39.4571	208,333	63,500.1	8,333.3

TABLE 23.—*Scale of velocity equivalents of the Beaufort scale of wind*

Beaufort scale no.	Description	Indicators of velocity	Velocity	
			Meters per second	Miles per hour
0	Calm	Calm air; smoke rises vertically.	Less than 0.3	Less than 1.
1	Light air	Direction of wind shown by smoke drift, but not by wind vanes.	0.3 to 1.5	1 to 3.
2	Slight breeze	Wind felt on face; leaves rustle; ordinary vane moved by wind.	1.6 to 3.3	4 to 7.
3	Gentle breeze	Leaves and small twigs in constant motion; wind extends light flag.	3.4 to 5.4	8 to 12.
4	Moderate breeze	Raises dust and loose paper; small branches are moved.	5.5 to 7.9	13 to 18.
5	Fresh breeze	Small trees in leafsway; crested wavelets form on inland waters.	8.0 to 10.7	19 to 24.
6	Strong breeze	Large branches in motion; whistling heard in telegraph wires; umbrellas used with difficulty.	10.8 to 13.8	25 to 31.
7	High wind	Whole trees in motion; inconvenience felt when walking against wind.	13.9 to 17.1	32 to 38.
8	Gale	Breaks twigs off trees; wind generally impedes progress.	17.2 to 20.7	39 to 46.
9	Strong gale	Slight structural damage occurs to signs; branches broken.	20.8 to 24.4	47 to 54.
10	Whole gale	Trees uprooted or broken; considerable structural damage occurs.	24.5 to 28.4	55 to 63.
11	Storm	Very rarely experienced; accompanied by widespread damage; forests wind-thrown or broken off.	28.5 to 33.5	64 to 75.
12	Hurricane		33.6 or above	Above 75.

TABLE 24.—Relative humidity percent, pressure 29.0 inches, Fahrenheit temperatures

Dry-bulb tempera- ture °F.	Depression of wet bulb (dry-bulb temperature minus wet-bulb temperature)																							
	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24						
40.....	46	38	31	23	16	9	2																	
42.....	48	41	34	28	21	14	7	0																
44.....	51	44	37	31	24	18	12	5																
46.....	53	46	40	34	28	22	16	10	4															
48.....	54	48	42	36	31	25	19	14	8	3														
50.....	56	50	44	39	33	28	22	17	12	7	2													
52.....	58	52	46	41	36	30	25	20	15	10	6	0												
54.....	59	54	48	43	38	33	28	23	18	14	9	5	0											
56.....	61	55	50	45	40	35	31	26	21	17	12	8	4											
58.....	62	57	52	47	42	38	33	28	24	20	15	11	7	3										
60.....	63	58	53	49	44	40	35	31	27	22	18	14	10	6	2									
62.....	64	60	55	50	46	41	37	33	29	25	21	17	13	9	6	2								
64.....	66	61	56	52	48	43	39	35	31	27	23	20	16	12	9	5	2							
66.....	66	62	58	53	49	45	41	37	33	29	26	22	18	15	11	8	5	1						
68.....	67	63	59	55	51	47	43	39	35	31	28	24	21	17	14	11	8	4						
70.....	68	64	60	56	52	48	44	40	37	33	30	26	23	20	17	13	10	7						
72.....	69	65	61	57	53	49	46	42	39	35	32	28	25	22	19	16	13	10						
74.....	70	66	62	58	54	51	47	44	40	37	34	30	27	24	21	18	15	12						
76.....	70	67	63	59	55	52	48	45	42	38	35	32	29	26	23	20	17	14						
78.....	71	67	64	60	57	53	50	46	43	40	37	34	31	28	25	22	19	16						
80.....	72	68	64	61	57	54	51	47	44	41	38	35	32	29	27	24	21	18						
82.....	72	69	65	62	58	55	52	49	46	43	40	37	34	31	28	25	23	20						
84.....	73	70	66	63	59	56	53	50	47	44	41	38	35	32	30	27	25	22						
86.....	74	70	67	63	60	57	54	51	48	45	42	39	37	34	31	29	26	24						
88.....	74	71	67	64	61	58	55	52	49	46	43	41	38	35	33	30	28	25						
90.....	75	71	68	65	62	59	56	53	50	47	44	42	39	37	34	32	29	27						
92.....	75	72	69	65	62	59	57	54	51	48	45	43	40	38	35	33	30	28						
94.....	75	72	69	66	63	60	57	54	52	49	46	44	41	39	36	34	32	29						
96.....	76	73	70	67	64	61	58	55	53	50	47	45	42	40	37	35	33	31						
98.....	76	73	70	67	64	61	59	56	53	51	48	46	43	41	39	36	34	32						
100.....	77	74	71	68	65	62	59	57	54	52	49	47	44	42	40	37	35	33						
102.....	77	74	71	68	65	63	60	57	55	52	50	47	45	43	41	39	37	35						
104.....	77	74	72	69	66	63	61	58	56	53	51	48	46	44	42	40	39	37						
106.....	78	75	72	69	66	64	61	59	56	54	51	49	47	45	43	41	39	37						
108.....	78	75	72	70	67	64	62	59	57	54	52	50	47	45	43	41	39	37						

Dry-bulb tempera- ture °F.	Depression of wet bulb (dry-bulb temperature minus wet-bulb temperature)																							
	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42						
68.....	1																							
70.....	4	1																						
72.....	7	4	1																					
74.....	9	7	4	1																				
76.....	12	9	6	4	1																			
78.....	14	11	9	6	4	1																		
80.....	16	13	11	8	6	4																		
82.....	18	15	13	10	8	6	4	1																
84.....	20	17	15	12	10	8	6	4	2															
86.....	21	19	17	14	12	10	8	6	4	2														
88.....	23	21	18	16	14	12	10	8	6	4	2													
90.....	24	22	20	18	16	14	12	10	8	6	4	2	0											
92.....	26	24	22	19	17	15	13	11	9	8	6	4	2	0										
94.....	27	25	23	21	19	17	15	13	11	9	8	6	4	2	1									
96.....	29	26	24	22	20	18	17	15	13	11	9	7	6	4	3	1								
98.....	30	28	26	24	22	20	18	16	14	13	11	9	7	6	4	3	1							
100.....	31	29	27	25	23	21	19	18	16	14	12	11	9	7	6	4	3	1						
102.....	32	30	28	26	24	22	20	19	17	15	14	12	11	9	7	6	4	3						
104.....	33	31	29	27	25	24	22	20	18	17	15	14	12	11	9	7	6	4						
106.....	34	32	30	28	27	25	23	21	20	18	16	15	13	12	10	9	7	6						
108.....	35	33	31	29	28	26	24	22	21	19	18	16	15	13	12	10	9	7						
110.....	36	34	32	30	29	27	25	24	22	20	19	17	16	14	13	11	10	9						
112.....	37	35	33	31	30	28	26	25	23	21	20	18	17	15	14	13	11	10						
114.....	38	36	34	32	31	29	27	26	24	22	21	19	18	17	15	14	13	11						
116.....	38	37	35	33	31	30	28	27	25	23	22	20	19	18	16	15	14	12						
118.....	39	37	36	34	32	31	29	27	26	24	23	21	20	19	17	16	15	13						

TABLE 25.—*Quarter girth;<sup>1</sup> equivalents in true girth, diameter, area, and volume, United States measurement and metric system*

Quarter girth unit	United States measurement	Metric system
1 inch.....	{ In true girth=4 inches..... In diameter=1.2732 inches.....	In true girth=10.16 cm. In diameter=3.234 cm.
1 square foot per acre.....	=1.2732 square feet per acre.....	{ =0.118288 m <sup>2</sup> per acre. =0.29230 m <sup>2</sup> per hectare.
1 cubic foot per acre.....	=1.2732 cubic feet per acre.....	{ =0.036054 m <sup>3</sup> per acre. =0.089092 m <sup>3</sup> per hectare.

<sup>1</sup> A British unit used customarily in East Indian forestry, equivalent to about  $1\frac{1}{4}$  diameters. The converting factor from diameter to quarter girth would be  $\frac{\pi}{4}$  or 0.7854.

TABLE 26.—*Natural trigonometric functions, by half degrees*

Degree	Sin	Cos	Tan	Degree	Sin	Cos	Tan	Degree	Sin	Cos	Tan
° /				° /				° /			
0 30	0.0087	1.0000	0.0087	15 30	0.2672	0.9636	0.2773	30 30	0.5075	0.8616	0.5890
1	.0175	.9998	.0175	16	.2756	.9613	.2867	31	.5150	.8572	.6009
1 30	.0262	.9997	.0262	16 30	.2840	.9588	.2962	31 30	.5225	.8526	.6128
2	.0349	.9994	.0349	17	.2924	.9563	.3057	32	.5299	.8480	.6249
2 30	.0436	.9990	.0437	17 30	.3007	.9537	.3153	32 30	.5373	.8434	.6371
3	.0523	.9986	.0524	18	.3090	.9511	.3249	33	.5446	.8387	.6494
3 30	.0610	.9981	.0612	18 30	.3173	.9483	.3346	33 30	.5519	.8339	.6619
4	.0698	.9976	.0699	19	.3256	.9455	.3443	34	.5592	.8290	.6745
4 30	.0785	.9969	.0787	19 30	.3338	.9426	.3541	34 30	.5664	.8241	.6873
5	.0872	.9962	.0875	20	.3420	.9397	.3640	35	.5736	.8192	.7002
5 30	.0958	.9954	.0963	20 30	.3502	.9367	.3739	35 30	.5807	.8141	.7133
6	.1045	.9945	.1051	21	.3584	.9336	.3839	36	.5878	.8090	.7265
6 30	.1132	.9936	.1139	21 30	.3665	.9304	.3939	36 30	.5948	.8039	.7400
7	.1219	.9925	.1228	22	.3746	.9272	.4040	37	.6018	.7986	.7536
7 30	.1305	.9914	.1317	22 30	.3827	.9239	.4142	37 30	.6088	.7934	.7673
8	.1392	.9903	.1405	23	.3907	.9205	.4245	38	.6157	.7880	.7813
8 30	.1478	.9890	.1495	23 30	.3987	.9171	.4348	38 30	.6225	.7826	.7954
9	.1564	.9877	.1584	24	.4067	.9135	.4452	39	.6293	.7771	.8098
9 30	.1650	.9863	.1673	24 30	.4147	.9100	.4557	39 30	.6361	.7716	.8243
10	.1736	.9848	.1763	25	.4226	.9062	.4663	40	.6428	.7660	.8391
10 30	.1822	.9833	.1853	25 30	.4305	.9026	.4770	40 30	.6494	.7604	.8541
11	.1908	.9816	.1944	26	.4384	.8988	.4877	41	.6561	.7547	.8693
11 30	.1994	.9799	.2035	26 30	.4462	.8949	.4986	41 30	.6626	.7490	.8847
12	.2079	.9781	.2126	27	.4540	.8910	.5095	42	.6691	.7431	.9004
12 30	.2164	.9763	.2217	27 30	.4617	.8870	.5206	42 30	.6756	.7373	.9163
13	.2250	.9744	.2309	28	.4695	.8829	.5317	43	.6820	.7314	.9325
13 30	.2334	.9724	.2401	28 30	.4772	.8788	.5430	43 30	.6884	.7254	.9490
14	.2419	.9703	.2493	29	.4848	.8746	.5543	44	.6947	.7193	.9657
14 30	.2504	.9681	.2586	29 30	.4924	.8704	.5658	44 30	.7009	.7133	.9827
15	.2588	.9659	.2679	30	.5000	.8660	.5774	45	.7071	.7071	1.0000

TABLE 27.—*The International log rule*[Saw kerf  $\frac{1}{4}$  inch]<sup>1</sup>

Diameter (inches)	Volume in board feet of logs of indicated length in feet							Diameter, inches
	8	10	12	14	16	18	20	
4		5	5	5	5	5	10	4
5	5	5	10	10	10	15	15	5
6	10	10	15	15	20	25	25	6
7	10	15	20	25	30	35	40	7
8	15	20	25	35	40	45	50	8
9	20	30	35	45	50	60	70	9
10	30	35	45	55	65	75	85	10
11	35	45	55	70	80	95	105	11
12	45	55	70	85	95	110	125	12
13	55	70	85	100	115	135	150	13
14	65	80	100	115	135	155	175	14
15	75	95	115	135	160	180	205	15
16	85	110	130	155	180	205	235	16
17	95	125	150	180	205	235	265	17
18	110	140	170	200	230	265	300	18
19	125	155	190	225	260	300	335	19
20	135	175	210	250	290	330	370	20
21	155	195	235	280	320	365	410	21
22	170	215	260	305	355	405	455	22
23	185	235	285	335	390	445	495	23
24	205	255	310	370	425	485	545	24
25	220	280	340	400	460	525	590	25
26	240	305	370	435	500	570	640	26
27	260	330	400	470	540	615	690	27
28	280	355	430	510	585	665	745	28
29	305	385	465	545	630	715	800	29
30	325	410	495	585	675	765	860	30
31	350	440	530	625	720	820	915	31
32	375	470	570	670	770	875	980	32
33	400	500	605	715	820	930	1045	33
34	425	535	645	760	875	990	1110	34
35	450	565	685	805	925	1050	1175	35
36	475	600	725	855	980	1115	1245	36
37	505	635	770	905	1040	1185	1315	37
38	535	670	810	955	1095	1245	1390	38
39	565	710	855	1005	1155	1310	1465	39
40	595	750	900	1060	1220	1380	1540	40
41	625	785	950	1115	1280	1450	1620	41
42	655	825	995	1170	1345	1525	1705	42
43	690	870	1045	1230	1410	1600	1785	43
44	725	910	1095	1290	1480	1675	1870	44
45	755	955	1150	1350	1550	1755	1960	45
46	795	995	1200	1410	1620	1835	2050	46
47	830	1040	1255	1475	1695	1915	2140	47
48	865	1090	1310	1540	1770	2000	2235	48
49	905	1135	1370	1605	1845	2085	2330	49
50	940	1185	1425	1675	1920	2175	2425	50
51	980	1235	1485	1745	2000	2265	2525	51
52	1020	1285	1545	1815	2080	2355	2625	52
53	1060	1335	1605	1885	2165	2445	2730	53
54	1100	1385	1670	1960	2245	2540	2835	54
55	1145	1440	1735	2035	2330	2640	2945	55
56	1190	1495	1800	2110	2420	2735	3050	56
57	1230	1550	1865	2185	2510	2835	3165	57
58	1275	1605	1930	2265	2600	2935	3275	58
59	1320	1660	2000	2345	2690	3040	3390	59
60	1370	1720	2070	2425	2785	3145	3510	60

<sup>1</sup> Scale for seasoned lumber with  $\frac{1}{16}$ -inch shrinkage per 1-inch board, and saws cutting a  $\frac{1}{4}$ -inch kerf, or for green lumber, for saws cutting a  $\frac{3}{16}$ -inch kerf. For saws cutting a  $\frac{1}{8}$ -inch kerf add 10.5 percent. Formula:  $((D^2 \times 0.22) - 0.71D) \times 0.904762$  for 4-foot sections.

Taper allowance:  $\frac{1}{2}$  inch per 4 feet lineal.

NOTE.—The International log rule gives consistent results under good milling practice. It is the most fair rule for all classes of timber and logs and should be used for second-growth material particularly. For this reason the International volume tables are recommended.

TABLE 28.—*Scribner decimal C log rule*

[In tens—i. e., 0 omitted]

Diameter (inches)	Contents in board feet of logs of length indicated in feet									
	6	8	10	12	14	16	18	20	22	24
6	0.5	0.5	1	1	1	2	2	2	3	3
7	.5	1	1	2	2	3	3	3	4	4
8	1	1	2	2	3	3	3	4	4	4
9	1	2	3	3	3	4	4	4	5	6
10	2	3	3	3	4	5	6	7	8	9
11	2	3	4	4	5	7	8	8	9	10
12	3	4	5	6	7	8	9	10	11	12
13	4	5	6	7	8	10	11	12	13	15
14	4	6	7	9	10	11	13	14	16	17
15	5	7	9	11	12	14	16	18	20	21
16	6	8	10	12	14	16	18	20	22	24
17	7	9	12	14	16	18	21	23	25	28
18	8	11	13	16	19	21	24	27	29	32
19	9	12	15	18	21	24	27	30	33	36
20	11	14	17	21	24	28	31	35	38	42
21	12	15	19	23	27	30	34	38	42	46
22	13	17	21	25	29	33	38	42	46	50
23	14	19	23	28	33	38	42	47	52	57
24	15	21	25	30	35	40	45	50	55	61
25	17	23	29	34	40	46	52	57	63	69
26	19	25	31	37	44	50	56	62	69	75
27	21	27	34	41	48	55	62	68	75	82
28	22	29	35	44	51	58	65	73	80	87
29	23	31	38	46	53	61	68	76	84	91
30	25	33	41	49	57	66	74	82	90	99
31	27	36	44	53	62	71	80	89	98	106
32	23	37	46	55	64	74	83	92	101	110
33	29	39	49	59	69	78	88	98	108	118
34	30	40	50	60	70	80	90	100	110	120
35	33	44	55	66	77	88	98	109	120	131
36	35	46	58	69	81	92	104	115	127	138
37	39	51	64	77	90	103	116	129	142	154
38	40	54	67	80	93	107	120	133	147	160
39	42	56	70	84	98	112	126	140	154	168
40	45	60	75	90	105	120	135	150	166	181
41	48	64	79	95	111	127	143	159	175	191
42	50	67	84	101	117	134	151	168	185	201
43	52	70	87	105	122	140	157	174	192	209
44	51	74	93	111	129	148	166	185	204	222
45	57	76	95	114	133	152	171	190	209	228
46	59	79	99	119	139	159	178	198	218	238
47	62	83	104	124	145	166	186	207	228	248
48	65	86	108	130	151	173	194	216	238	260
49	67	90	112	135	157	180	202	225	247	270
50	70	94	117	140	164	187	211	234	257	281
51	73	97	122	146	170	195	219	243	268	292
52	75	101	127	152	177	202	228	253	278	304
53	79	105	132	158	184	210	237	263	289	316
54	82	109	137	164	191	218	246	273	300	328
55	85	113	142	170	198	227	255	283	312	340
56	88	118	147	176	205	235	264	294	323	353
57	91	122	152	183	213	244	274	304	335	365
58	95	126	158	189	221	252	284	315	347	379
59	98	131	163	196	229	261	294	327	359	392
60	101	135	169	203	237	270	304	338	372	406

Diameter given is for the small end of the log measured inside bark.

TABLE 29.—Solid cubic contents of logs

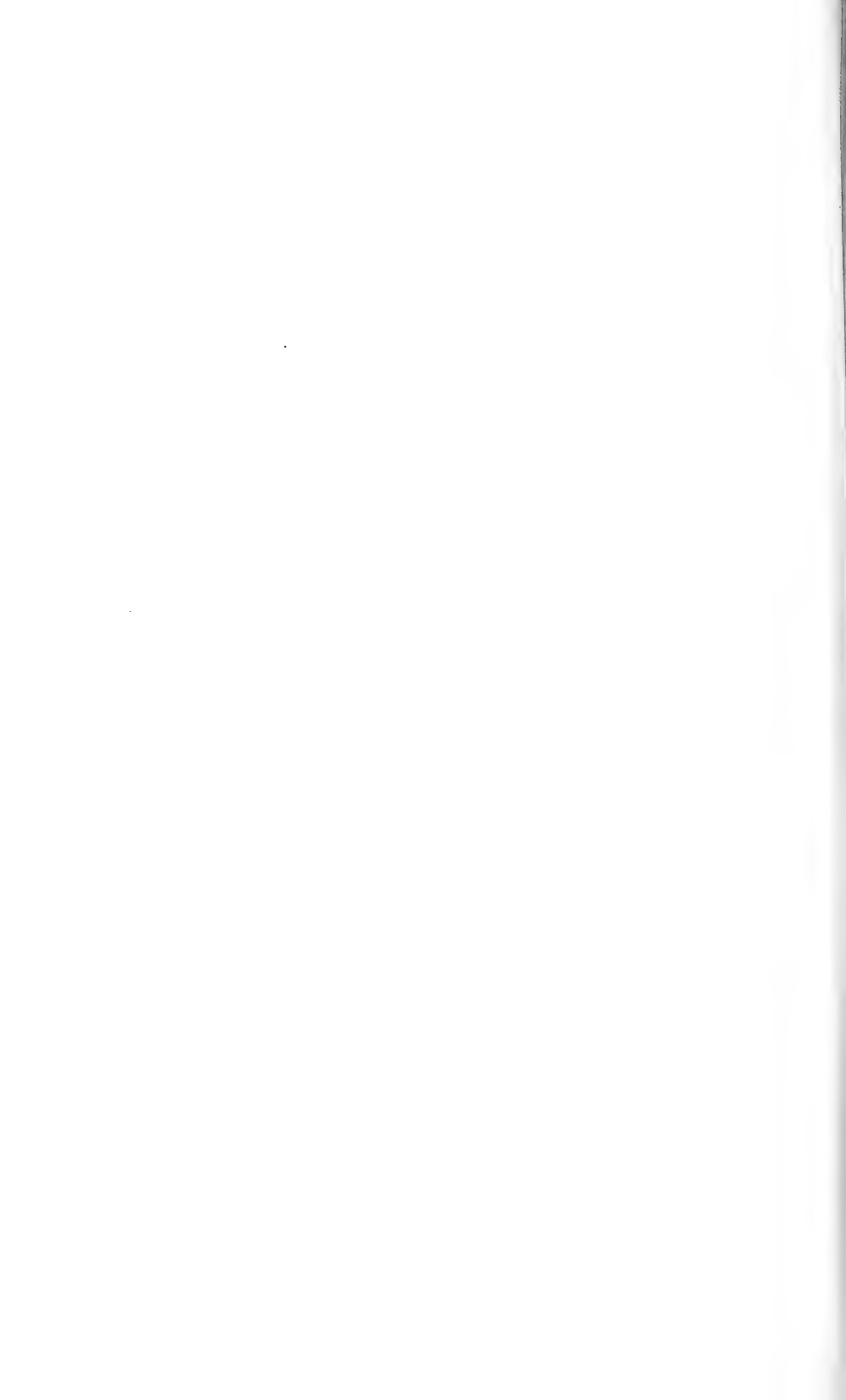
Length (feet)	Contents in cubic feet for average middle diameter of log in inches indicated																			
	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
4	0.25	0.25	0.5	1	1	1	2	2	3	3	4	4	5	6	6	7	8	9		
5	.25	.5	1	1	2	2	3	3	4	5	6	6	7	8	9	10	11	12	13	14
6	.25	.5	1	1	2	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
7	.25	.5	1	1	2	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
8	.5	1	1	2	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
9	.5	1	1	2	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
10	.5	1	1	2	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
11	.5	1	1	2	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
12	.5	1	1	2	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
13	.5	1	1	2	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
14	.5	1	1	2	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
15	.5	1	1	2	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
16	1	1	2	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
17	1	2	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
18	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
19	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
20	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
21	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
22	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
23	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
25	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
26					5	7	9	12	15	18	21	24	28	32	36	41	46	51	57	
27					5	7	9	12	15	18	21	24	28	32	36	41	46	51	57	
28					5	7	10	12	15	18	22	26	30	34	39	44	49	55	61	
29					6	8	10	13	16	19	23	27	31	36	40	46	51	57	63	
30					6	8	10	13	16	20	24	28	32	37	42	47	53	59	65	
31					6	8	11	14	17	20	24	29	33	38	43	49	55	61	68	
32					6	9	11	14	17	21	25	29	34	39	45	50	57	63	70	

Length (feet)	Contents in cubic feet for average middle diameter of log in inches indicated																			
	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
4	10	11	12	13	14	15	16	17	18	20	21	22	24	25	27	28	30	32	33	35
5	12	13	14	16	17	18	20	21	23	25	26	28	30	32	33	35	37	39	41	44
6	14	16	17	19	20	22	24	26	28	29	31	34	36	38	40	42	45	47	50	52
7	17	18	20	22	24	26	28	30	32	34	37	39	42	44	47	49	52	55	58	61
8	19	21	23	25	27	29	32	34	37	39	42	45	48	50	53	57	60	63	66	70
9	22	24	26	28	31	33	36	38	41	44	47	50	53	57	60	64	67	71	75	79
10	24	26	29	31	34	37	40	43	46	49	52	56	59	63	67	71	75	79	83	87
11	26	29	32	35	37	41	44	47	50	54	58	61	65	69	73	78	82	87	91	96
12	29	32	35	38	41	44	48	51	55	59	63	67	71	76	80	85	90	95	100	105
13	31	34	38	41	44	48	52	56	60	64	68	73	77	82	87	92	97	102	108	113
14	34	37	40	44	48	52	56	60	64	69	74	79	83	88	94	99	105	110	116	122
15	36	40	43	47	51	55	60	64	69	74	79	84	89	95	101	107	113	118	124	131
16	38	42	46	50	55	59	64	68	73	78	83	89	95	101	107	113	119	126	133	140
17	41	45	49	53	58	63	68	73	78	83	89	95	101	107	114	120	127	134	141	148
18	43	48	52	57	61	66	72	77	83	88	94	101	107	113	120	127	134	142	149	157
19	46	50	55	60	65	70	76	81	87	93	100	106	113	120	127	134	142	150	158	166
20	48	53	58	63	68	74	80	86	92	98	105	112	119	126	134	141	149	158	166	175
21	51	55	61	66	72	77	83	90	96	103	110	117	125	132	140	148	157	165	174	183
22	53	58	63	69	75	81	87	94	101	108	115	123	131	139	147	156	164	173	183	192
23	55	61	66	72	78	85	91	98	105	113	121	128	137	145	154	163	172	181	191	201
24	58	63	69	75	82	88	95	103	110	118	126	134	143	151	160	170	179	189	199	209
25	60	66	72	79	85	92	99	107	115	123	131	140	148	158	167	177	187	197	207	218
26	63	69	75	82	89	96	103	111	119	128	136	145	154	164	174	184	194	205	216	227
27	65	71	78	85	92	100	107	115	124	133	142	151	160	170	180	191	202	213	224	236
28	67	74	81	88	95	103	111	120	128	137	147	156	166	177	187	198	209	221	232	244
29	70	77	84	91	99	107	115	124	133	142	152	162	172	183	194	205	217	228	241	253
30	72	79	87	94	102	111	119	128	138	147	157	168	178	189	200	212	224	236	249	262
31	75	82	89	97	106	114	123	133	142	152	162	173	184	195	207	219	231	244	257	271
32	77	84	92	101	109	118	127	137	147	157	168	179	190	202	214	226	239	252	265	279

TABLE 30.—Comparison of log rules

Top diam- eter inside bark (inches)	Board foot values for 16-foot logs for log rules and in percentage of International <sup>1</sup>																
	Inter- na- tional ¾ kerf	Scribner		Scribner Decimal C		Spauld- ing		Doyle		Doyle and Scribner		Holland or Maine		Blodgett or New Hamp- shire		Hum- phrey or Vermont	
		Bd. ft.	Per- cent	Bd. ft.	Per- cent	Bd. ft.	Per- cent	Bd. ft.	Per- cent	Bd. ft.	Per- cent	Bd. ft.	Per- cent	Bd. ft.	Per- cent	Bd. ft.	Per- cent
4	5	(10)	200	(10)	200							(3)	60	13	260	11	220
5	10	(13)	130	(10)	100			1	10	1	10	(11)	110	19	190	16	160
6	23	18	90	20	100			4	20	4	20	20	100	26	130	24	120
7	30	24	80	30	100			9	30	9	30	31	103	35	117	32	107
8	40	32	80	30	75			16	40	16	40	44	110	43	108	43	108
9	50	42	84	40	80			25	50	25	50	52	104	54	108	53	106
10	65	54	83	60	92	50	77	36	55	36	55	68	105	66	102	67	103
11	85	64	80	70	88	63	79	49	61	49	61	83	104	78	98	80	100
12	95	79	83	80	84	77	81	64	67	64	67	105	111	92	97	96	101
13	115	97	84	100	87	94	82	81	70	81	70	120	104	106	92	112	97
14	135	114	81	110	81	114	84	100	74	100	74	142	105	123	91	131	97
15	160	142	89	140	88	137	86	121	76	121	76	161	101	139	87	149	93
16	180	159	88	160	89	161	89	144	80	144	80	179	99	157	87	171	95
17	205	185	90	180	88	188	92	169	82	169	82	205	100	176	86	192	94
18	230	213	93	210	91	216	94	196	85	196	85	232	101	197	86	216	94
19	260	240	92	240	92	245	94	225	87	225	87	271	104	217	83	240	92
20	290	280	97	280	97	276	95	256	88	256	88	302	104	240	83	267	92
21	320	304	95	300	94	308	96	289	90	289	90	336	105	265	82	293	92
22	355	334	94	330	93	341	96	324	91	324	91	363	102	287	81	323	91
23	390	377	97	380	97	376	96	361	93	361	93	401	103	313	80	352	90
24	425	404	95	400	94	412	97	400	94	400	94	439	103	339	80	384	90
25	450	459	100	460	100	449	98	441	96	441	96	477	104	367	80	416	90
26	500	500	100	500	100	488	98	484	97	484	97	507	101	397	79	451	90
27	540	548	101	550	102	528	98	529	98	530	98	546	101	426	79	485	90
28	585	582	99	580	99	569	97	576	98	582	99	614	105	457	78	523	89
29	630	609	97	610	97	612	97	625	99	609	97	657	104	489	78	560	89
30	675	657	97	660	98	656	97	676	100	657	97	706	105	514	76	600	89
31	710	710	99	710	99	701	97	728	101	710	99	755	105	557	77	640	89
32	770	736	96	740	96	748	97	784	102	736	96	792	103	592	77	683	89
33	820	784	96	780	95	796	97	841	103	784	96	848	103	628	77	725	88
34	875	800	91	800	91	845	97	900	103	800	91	900	103	666	76	771	88
35	925	876	95	880	95	897	97	961	101	876	95	949	103	704	76	816	88
36	980	923	94	920	94	950	97	1,024	104	923	94	1,026	105	744	76	864	88
37	1,010	1,029	99	1,030	99	1,006	97	1,089	105	1,029	99	1,089	105	785	75	912	88
38	1,095	1,068	98	1,070	98	1,064	97	1,156	106	1,068	98	1,135	104	827	76	963	88
39	1,155	1,120	97	1,120	97	1,124	97	1,225	106	1,120	97	1,209	105	870	75	1,013	88
40	1,220	1,204	99	1,200	98	1,185	97	1,296	106	1,204	99	1,261	103	914	75	1,067	87

<sup>1</sup> International log rule for saws cutting a ¾-inch kerf taken as a standard=100 percent.





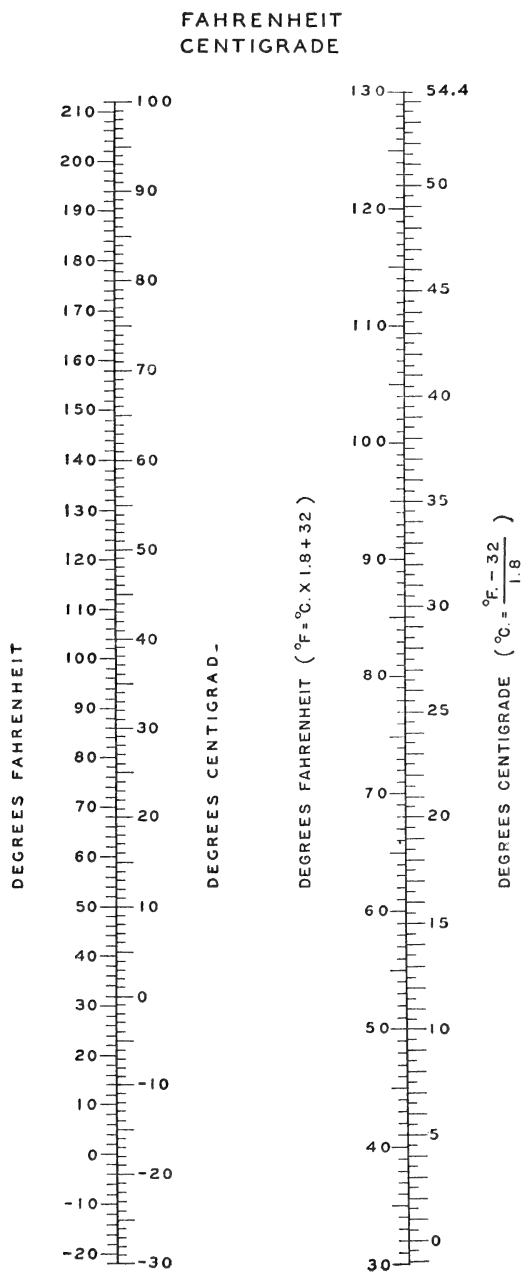
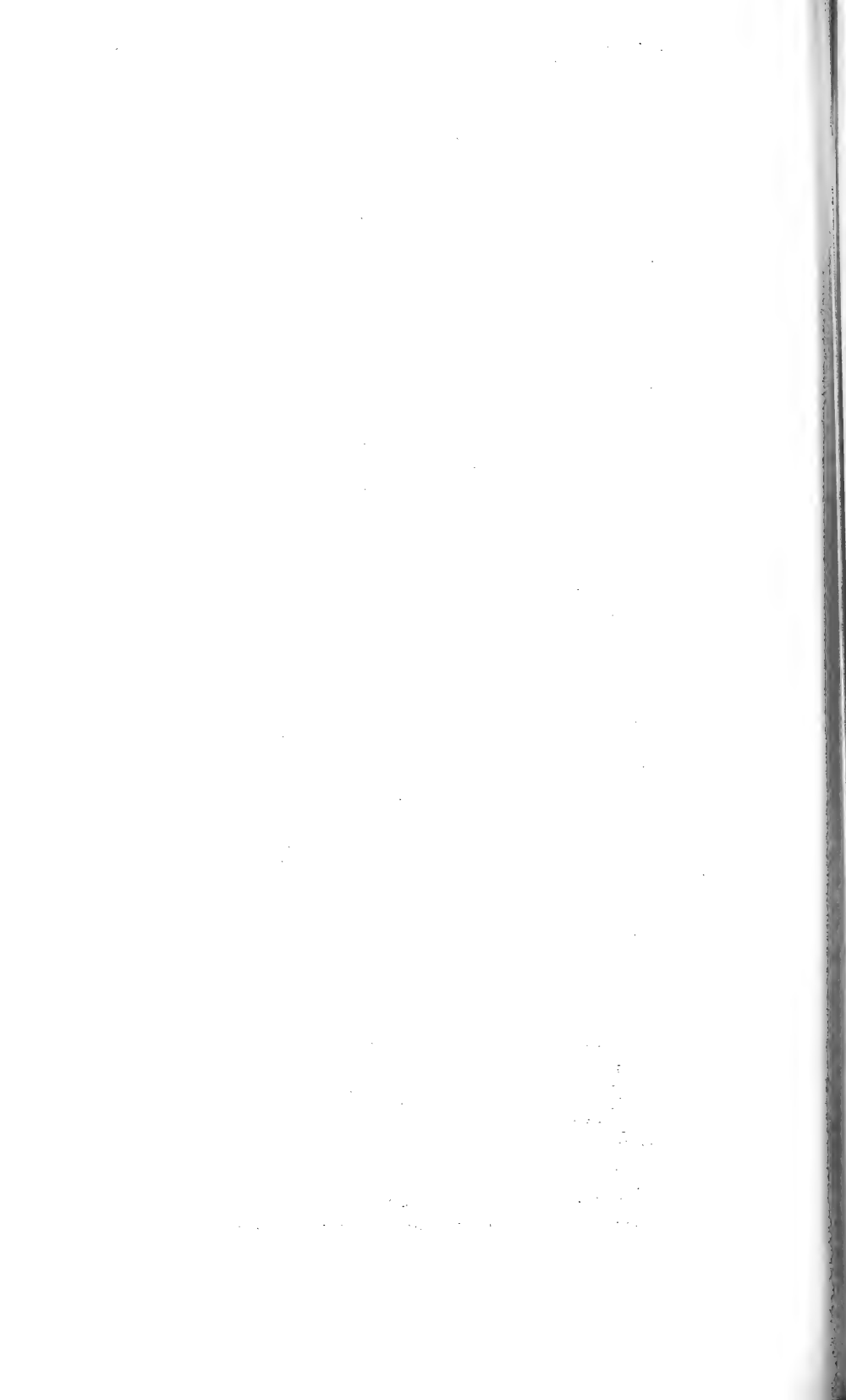


FIGURE 1.—Temperature alinement chart for converting Fahrenheit to centigrade.



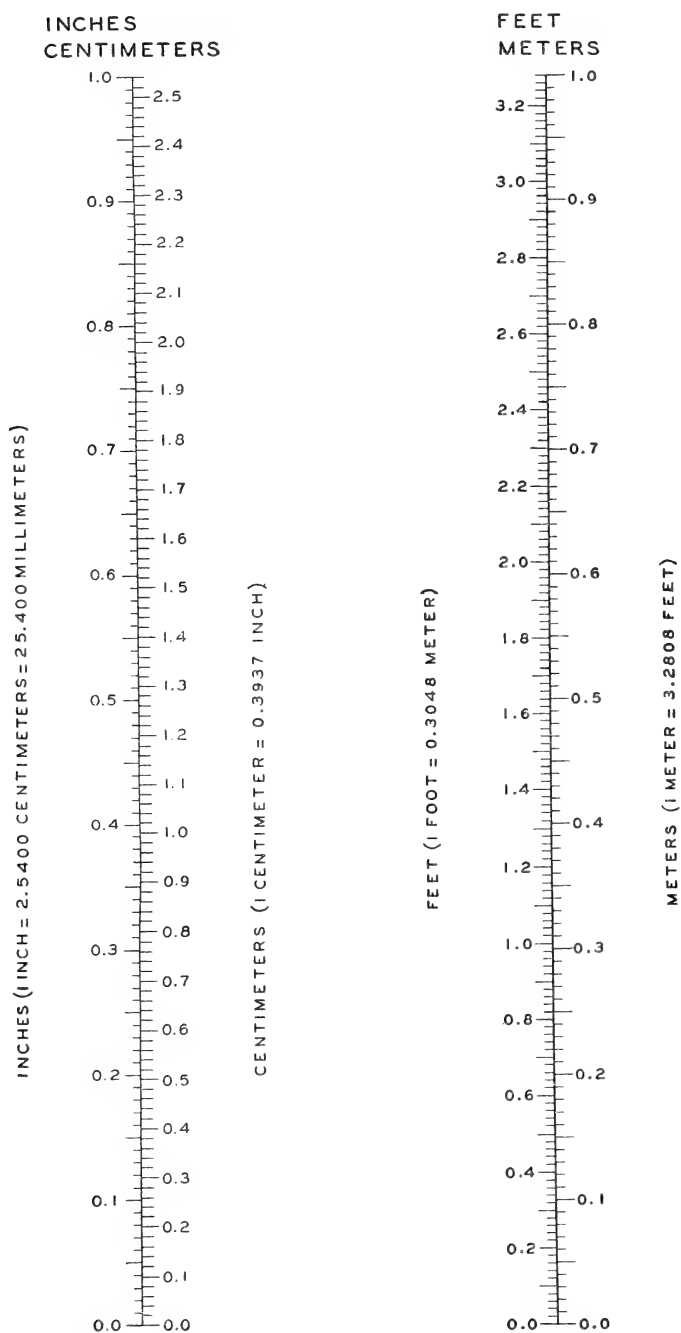


FIGURE 2.—Alinement charts for converting inches to centimeters and feet to meters.



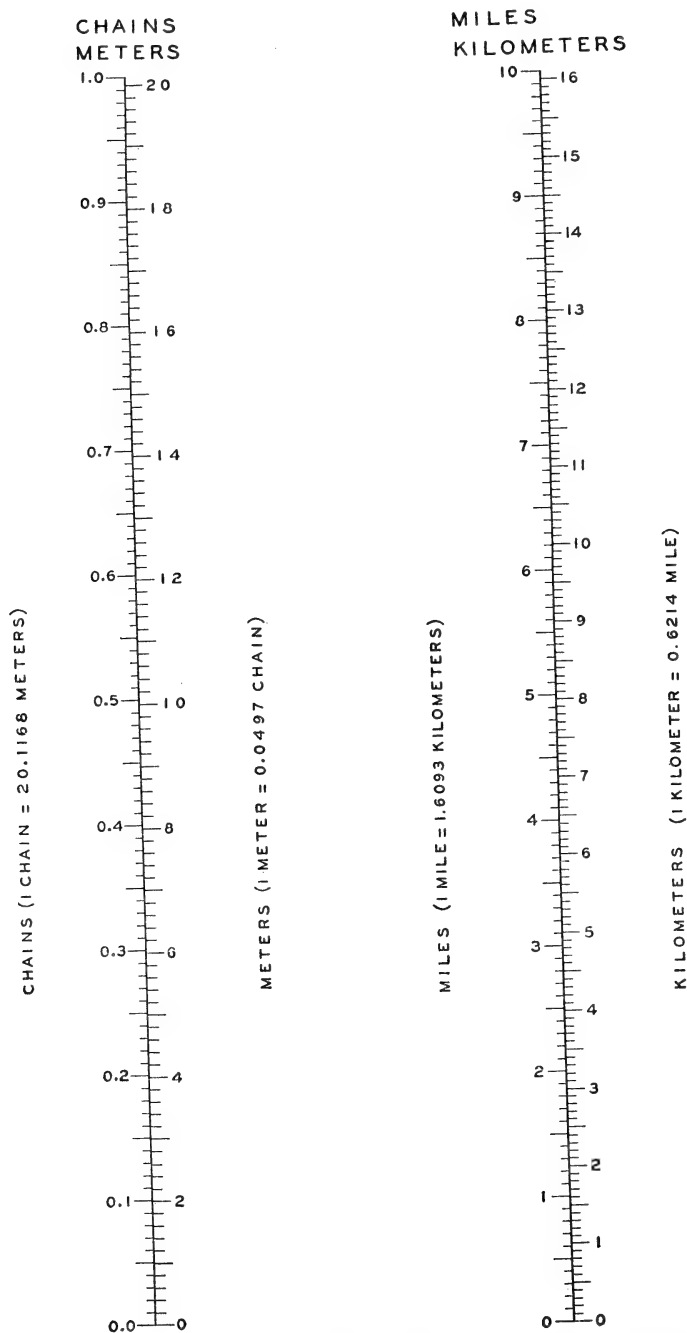
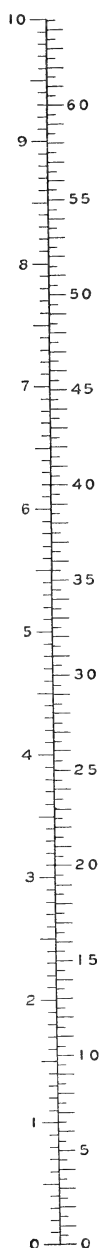


FIGURE 3.—Alinement charts for converting chains to meters and miles to kilometers.



SQUARE INCHES  
SQUARE CENTIMETERS

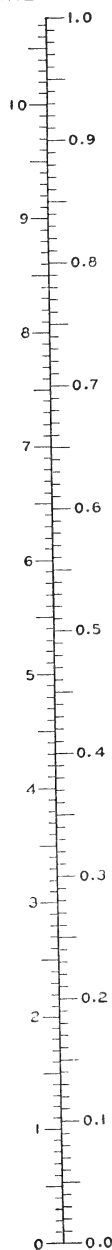
SQUARE INCHES (1 SQUARE INCH = 6.45163 SQUARE CENTIMETERS)



SQUARE CENTIMETERS (1 SQUARE CENTIMETER = 0.15500 SQUARE INCH)

SQUARE FEET  
SQUARE METERS

SQUARE FEET (1 SQUARE FOOT = 0.0929 SQUARE METER)



SQUARE METERS (1 SQUARE METER = 10.7639 SQUARE FEET)

FIGURE 4.—Alinement charts for converting square inches to square centimeters and square feet to square meters.





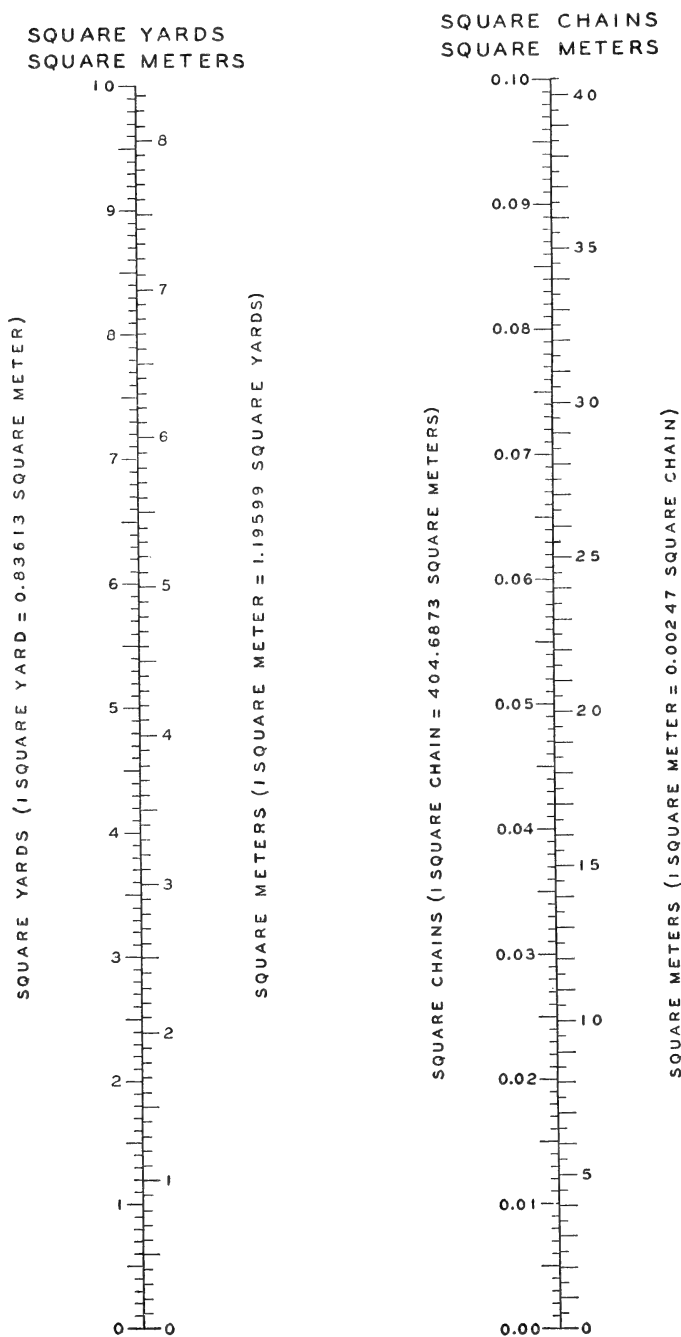


FIGURE 5.—Alinement charts for converting square yards to square meters and square chains to square meters.



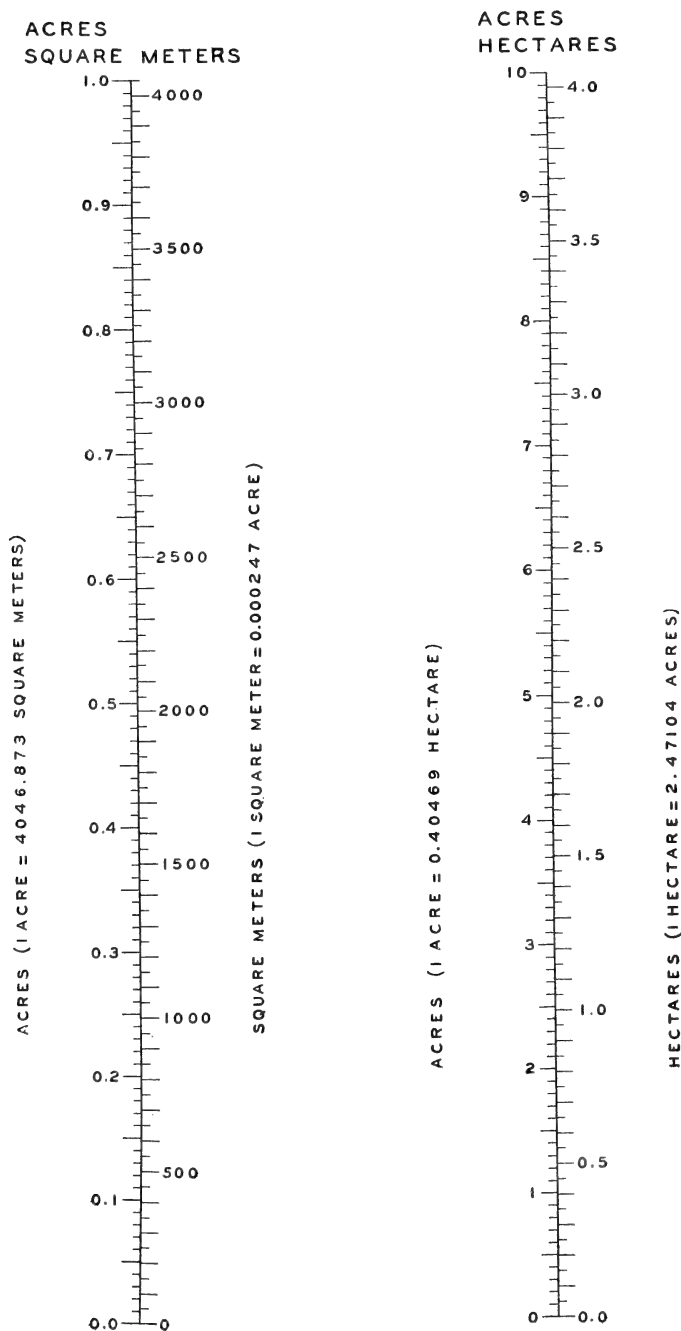


FIGURE 6.—Alinement charts for converting acres to square meters and hectares.



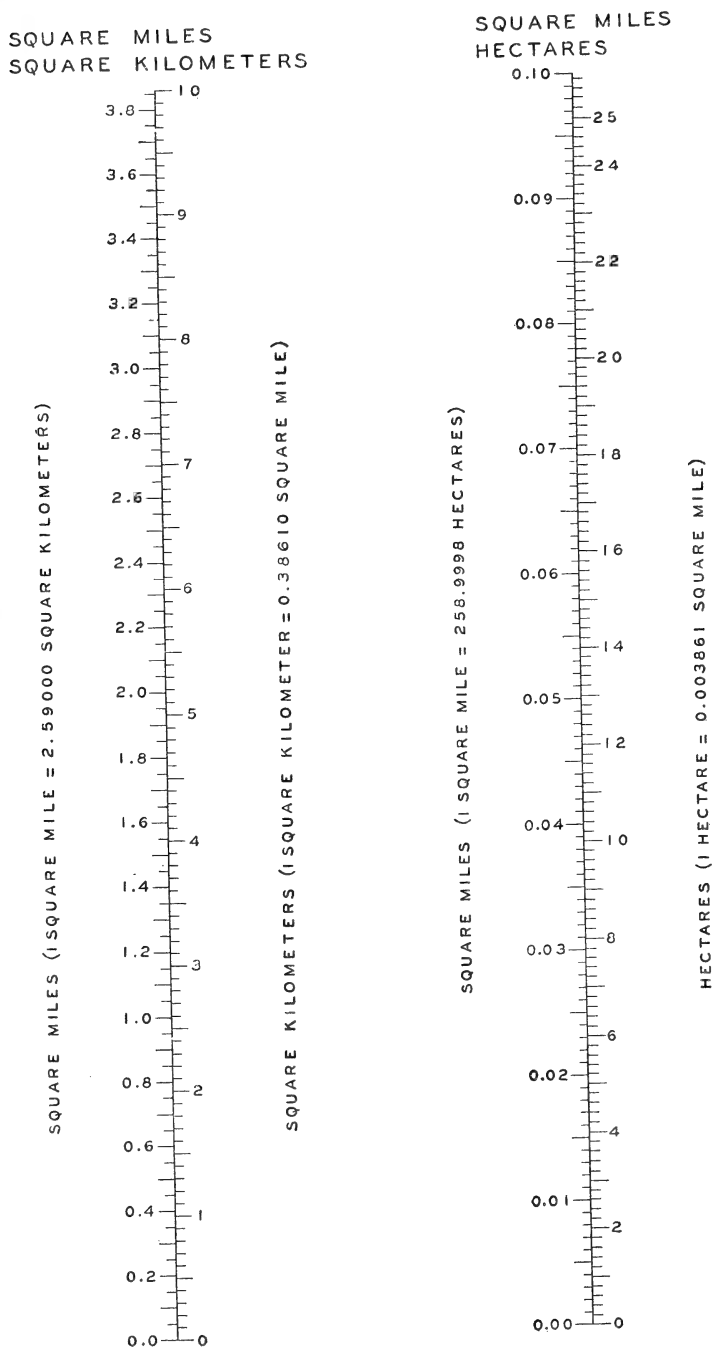
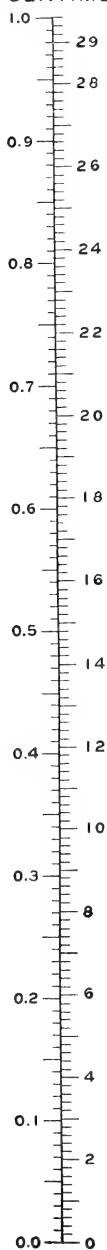


FIGURE 7.—Alinement charts for converting square miles to square kilometers and hectares.



FLUID OUNCES  
CUBIC CENTIMETERS

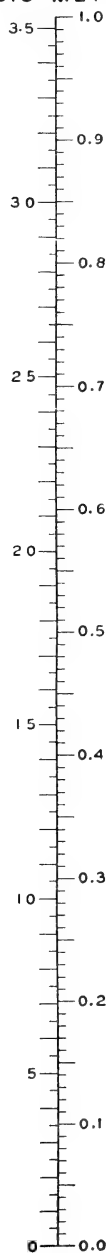
FLUID OUNCES (1 FLUID OUNCE = 29.5737 CUBIC CENTIMETERS)



CUBIC CENTIMETERS (1 CUBIC CENTIMETER = 0.0338 FLUID OUNCE)

CUBIC FEET  
CUBIC METERS

CUBIC FEET (1 CUBIC FOOT = 0.0283 CUBIC METER)



CUBIC METERS (1 CUBIC METER = 35.3145 CUBIC FEET)

FIGURE 8.—Alinement charts for converting fluid ounces to cubic centimeters and cubic feet to cubic meters.





U.S. GALLONS  
IMPERIAL GALLONS

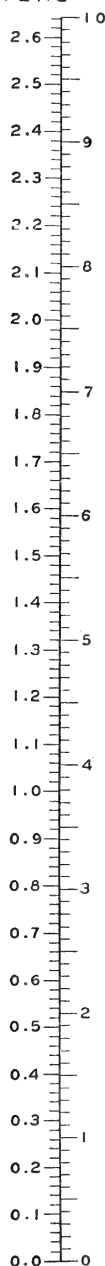
U.S. GALLONS (1 U.S. GALLON = 0.83268 IMPERIAL GALLON)



IMPERIAL GALLONS (1 IMPERIAL GALLON = 1.20094 U.S. GALLONS)

U.S. GALLONS  
LITERS

U.S. GALLONS (1 GALLON = 3.78533 LITERS)

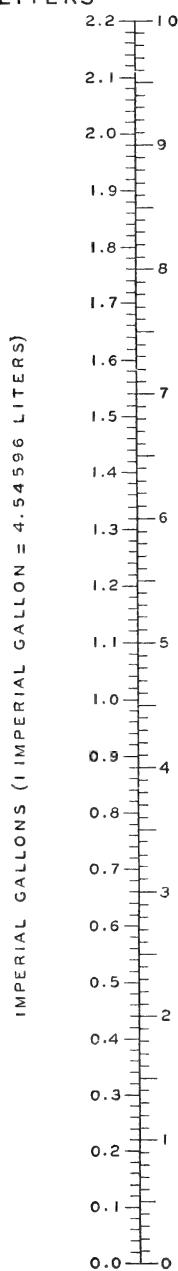


LITERS (1 LITER = 0.26418 GALLON)

FIGURE 9.—Alinement charts for converting United States gallons to imperial gallons and liters.



IMPERIAL GALLONS  
LITERS



LITERS (1 LITER = 0.21998 IMPERIAL GALLON)

BUSHEL  
HECTOLITERS

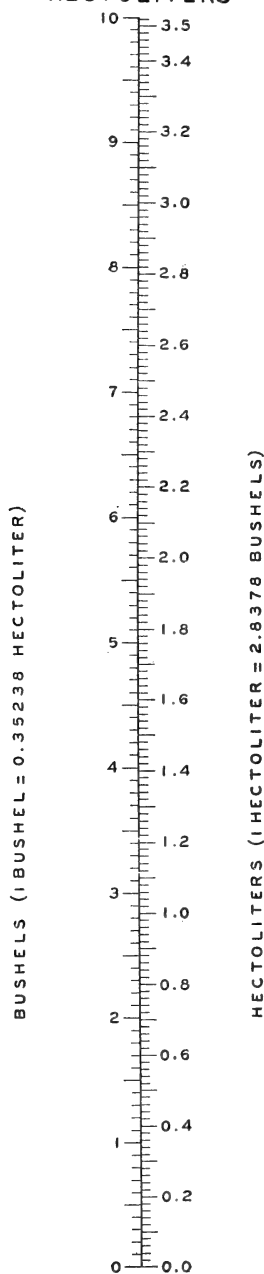
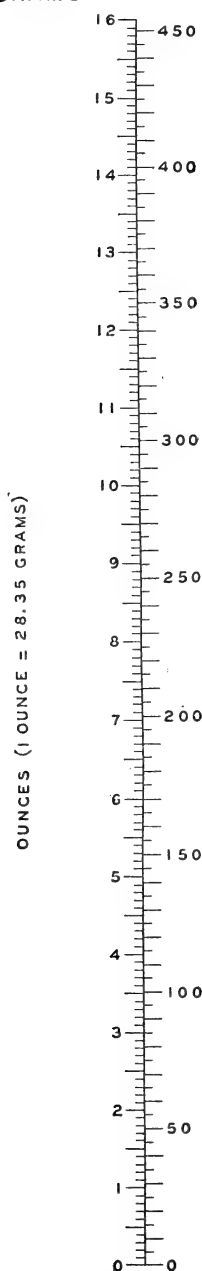


FIGURE 10.—Alinement charts for converting imperial gallons to liters and bushels to hectoliters.

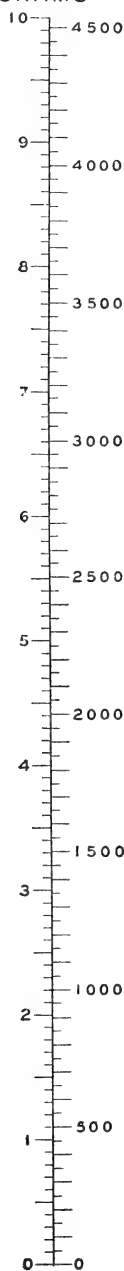


OUNCES (AVOIRDUPOIS)  
GRAMS



GRAMS (1 GRAM = 0.0353 OUNCE)

POUNDS  
GRAMS



GRAMS (1 GRAM = 0.0022 POUND)

FIGURE 11.—Alinement charts for converting avoirdupois ounces to grams and pounds to grams.



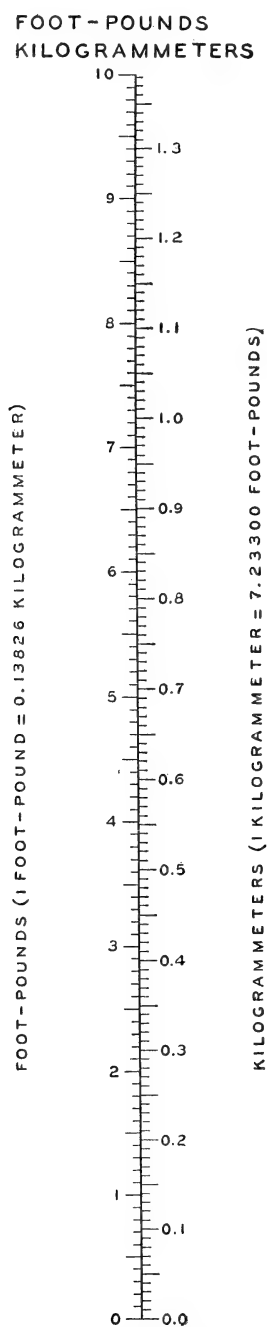


FIGURE 12.—Alinement chart for converting foot-pounds to kilogrammeters.





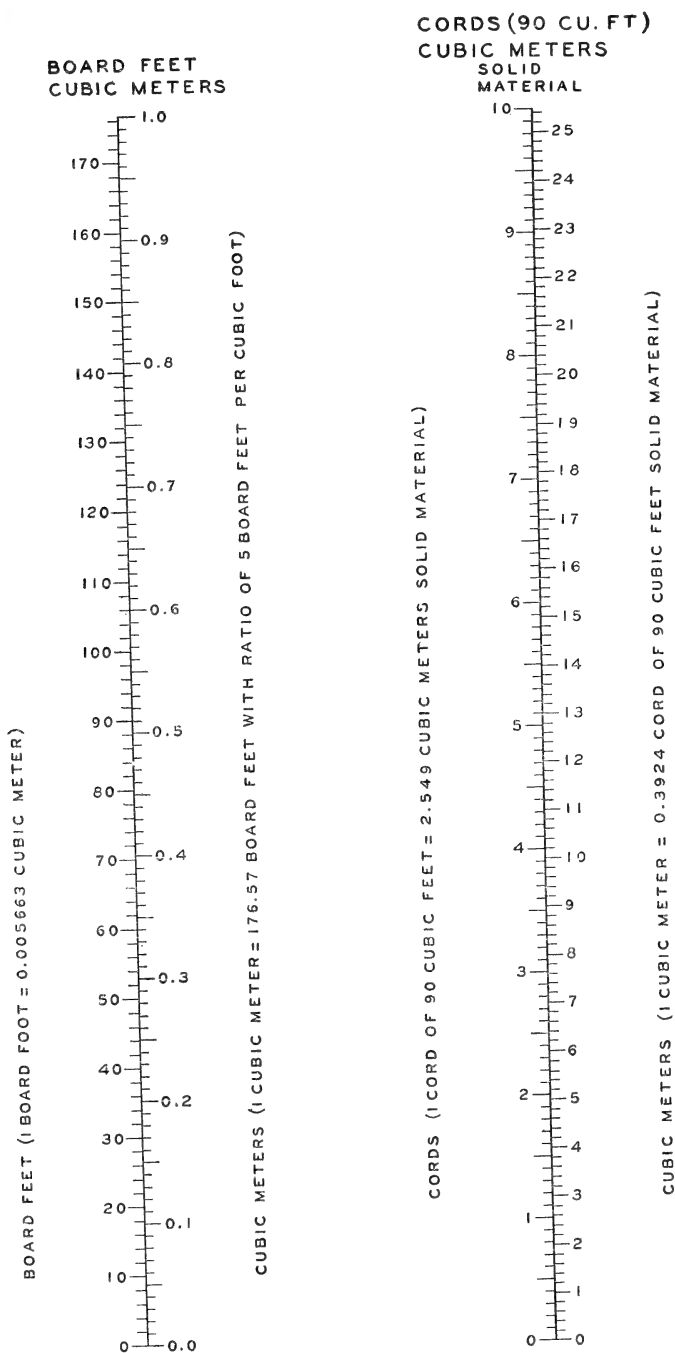
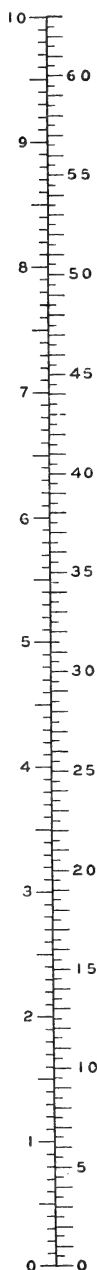


FIGURE 13.—Alignment charts for converting board feet to cubic meters and cords to cubic meters.



**CORDS PER ACRE**  
**CUBIC METERS PER HECTARE**

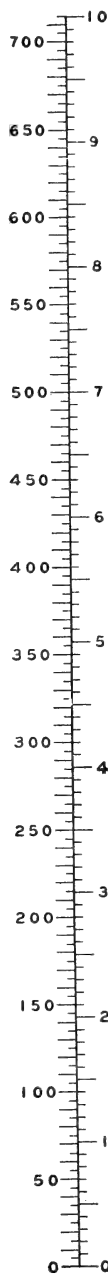
CORDS PER ACRE (1 CORD OF 90 CUBIC FEET = 2.549 CUBIC METERS SOLID MATERIAL)  
1 CORD PER ACRE = 6.2975 CUBIC METERS PER HECTARE



CUBIC METERS PER HECTARE (1 CUBIC METER = 0.3924 CORD OF 90 CUBIC FEET SOLID MATERIAL)  
1 CUBIC METER PER HECTARE = 0.1588 CORD PER ACRE

**BOARD FEET PER ACRE**  
**CUBIC METERS PER HECTARE**

1 BOARD FOOT PER ACRE = 0.01399 CUBIC METER PER HECTARE  
1 BOARD FOOT = 0.0057 CUBIC METER  
BOARD FEET PER ACRE (1 ACRE = 0.4047 HECTARE)



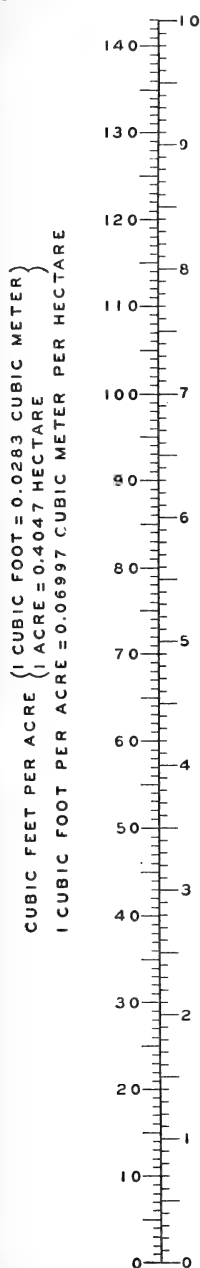
CUBIC METERS PER HECTARE (1 CUBIC METER = 176.57 BOARD FEET)  
1 HECTARE = 2.4710 ACRES  
1 CUBIC METER PER HECTARE = 71.457 BOARD FEET PER ACRE

5 BD. FT. = 1 CU. FT.

FIGURE 14.—Alinement charts for converting cords per acre to cubic meters per hectare and board feet per acre to cubic meters per hectare.

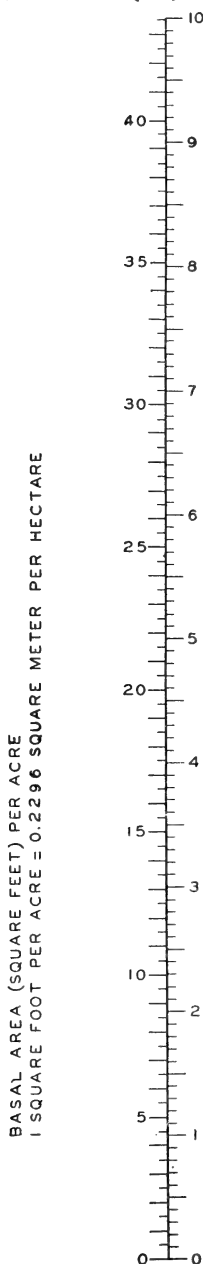


CUBIC FEET PER ACRE  
CUBIC METERS PER HECTARE



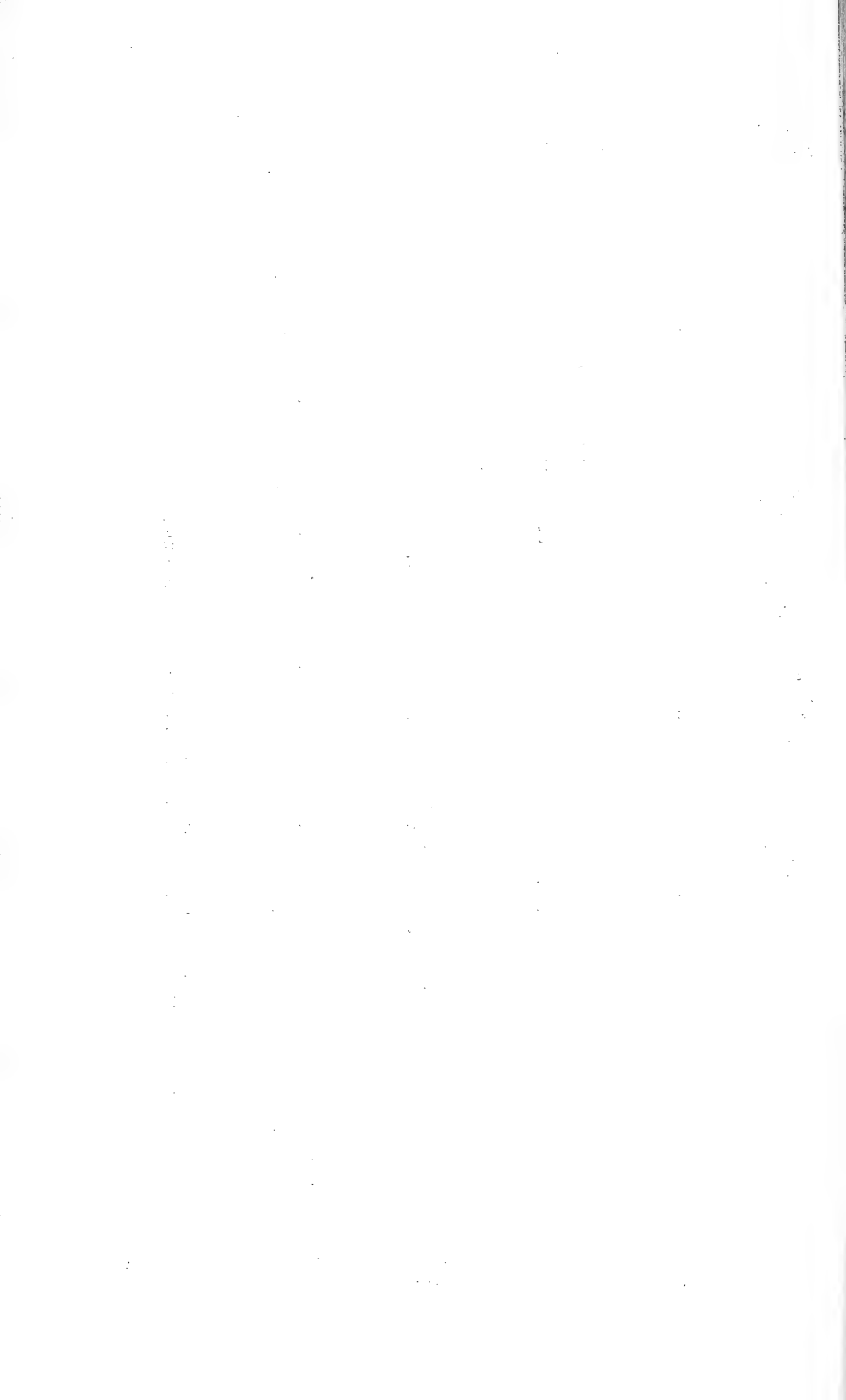
CUBIC METERS PER HECTARE  $\left\{ \begin{array}{l} 1 \text{ CUBIC METER} = 35.3145 \text{ CUBIC FEET} \\ 1 \text{ HECTARE} = 2.4710 \text{ ACRES} \end{array} \right\}$   
 1 CUBIC METER PER HECTARE = 14.2913 CUBIC FEET PER ACRE

BASAL AREA (FT<sup>2</sup>) PER ACRE  
BASAL AREA (M<sup>2</sup>) PER HECTARE



BASAL AREA (SQUARE METERS) PER HECTARE  
 1 SQUARE METER PER HECTARE = 4.3560 SQUARE FEET PER ACRE

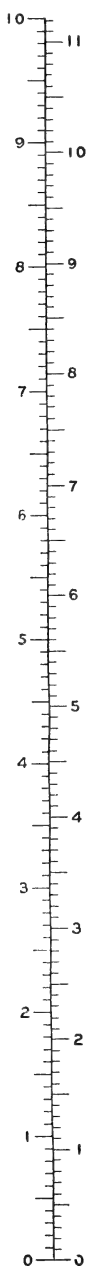
FIGURE 15.—Alinement charts for converting cubic feet per acre to cubic meters per hectare and basal area (square feet) per acre to basal area (square meters) per hectare.



POUNDS PER ACRE  
KILOGRAMS PER HECTARE

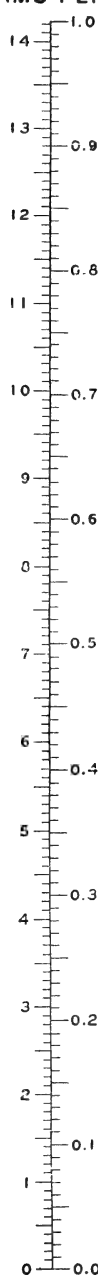
POUNDS PER SQ. IN.  
KILOGRAMS PER SQ. CM.

POUNDS PER ACRE (1 POUND = 0.4536 KILOGRAM)  
1 POUND PER ACRE = 1.1208 KILOGRAMS PER HECTARE



KILOGRAMS PER HECTARE (1 KILOGRAM = 2.2046 POUNDS)  
1 KILOGRAM PER HECTARE = 0.922 POUND PER ACRE

POUNDS PER SQUARE INCH (1 POUND PER SQUARE INCH = 0.07031 KILOGRAM PER SQUARE CENTIMETER)



KILOGRAMS PER SQUARE CENTIMETER (1 KILOGRAM PER SQUARE CENTIMETER = 14.2234 POUNDS PER SQUARE INCH)

FIGURE 16.—Alinement charts for converting pounds per acre to kilograms per hectare and pounds per square inch to kilograms per square centimeter.





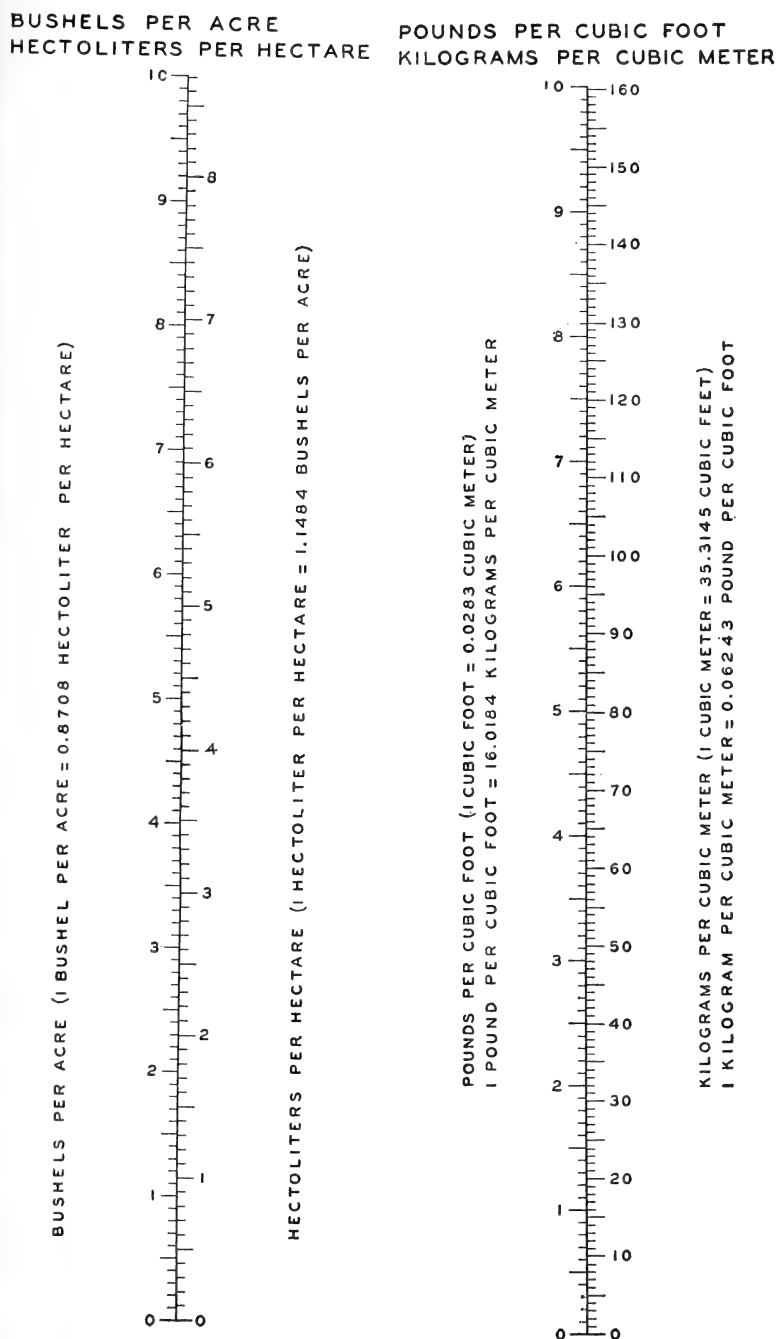


FIGURE 17.—Alinement charts for converting bushels per acre to hectoliters per hectare and pounds per cubic foot to kilograms per cubic meter.

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CUBIC FEET PER SECOND  
ACRE-FEET PER DAY

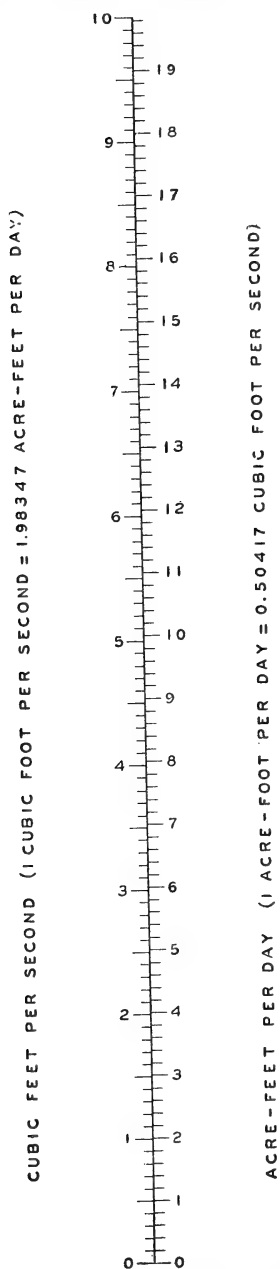


FIGURE 18.—Alinement chart for converting cubic feet per second to acre-feet per day



DOLLARS PER ACRE  
MARKS PER HECTARE

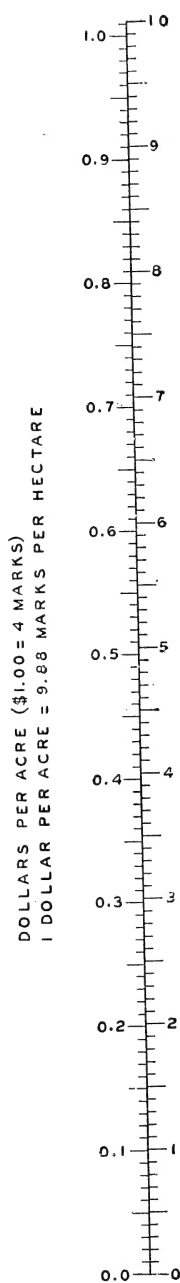
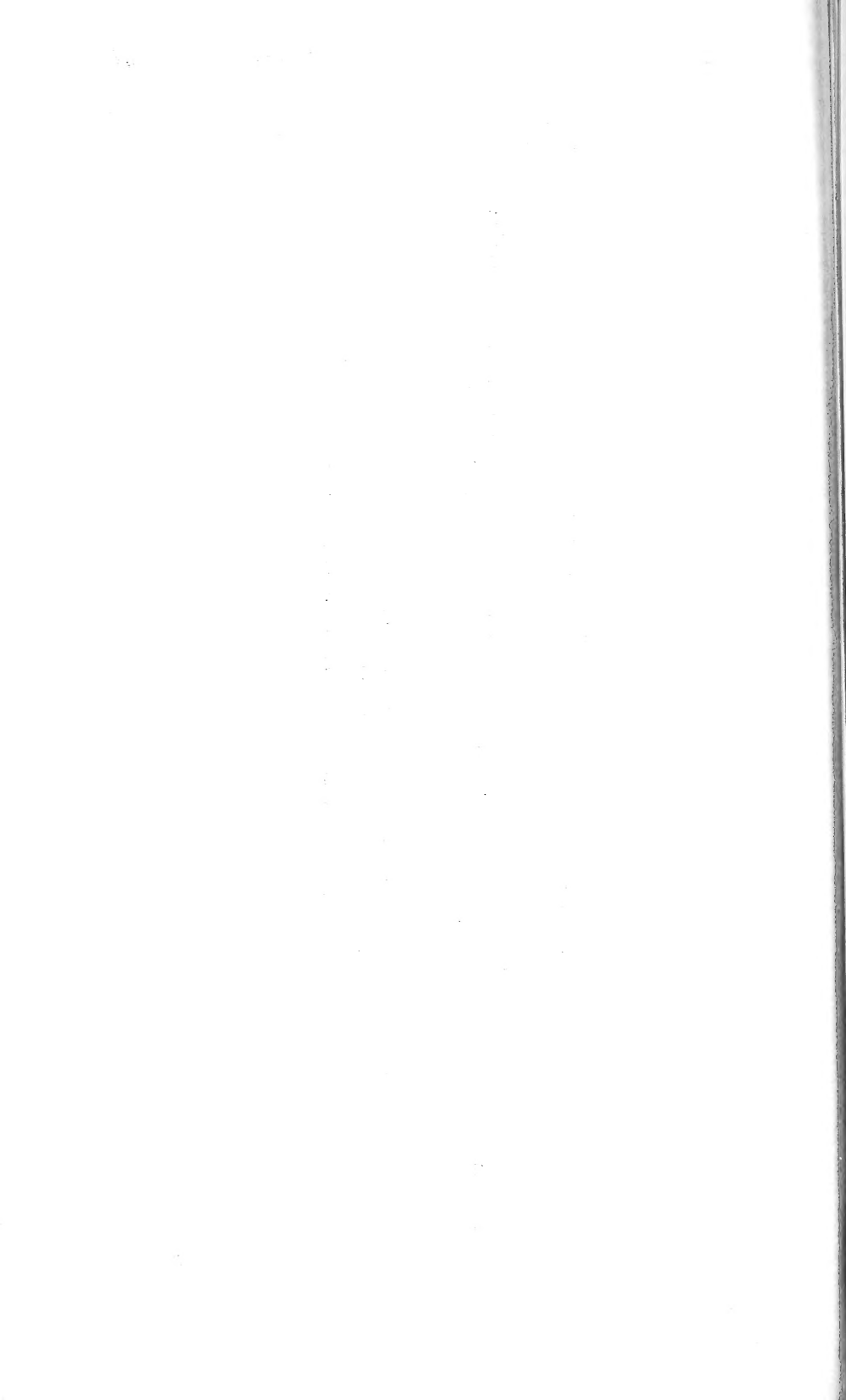


FIGURE 19.—Alinement chart for converting dollars per acre to marks per hectare. Value of foreign currency approximate.



RELATION OF COEFFICIENTS OF  
CORRELATION (R) AND ALIENATION (K)

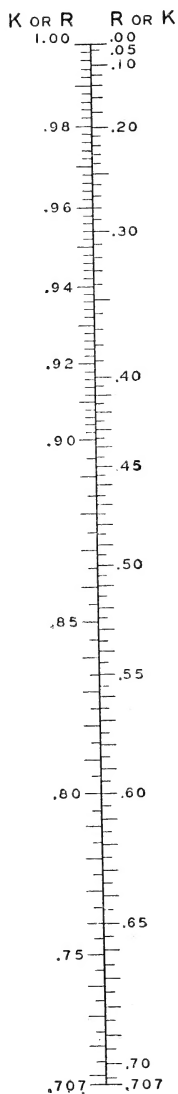


FIGURE 20.—Coefficients of correlation.

5/31